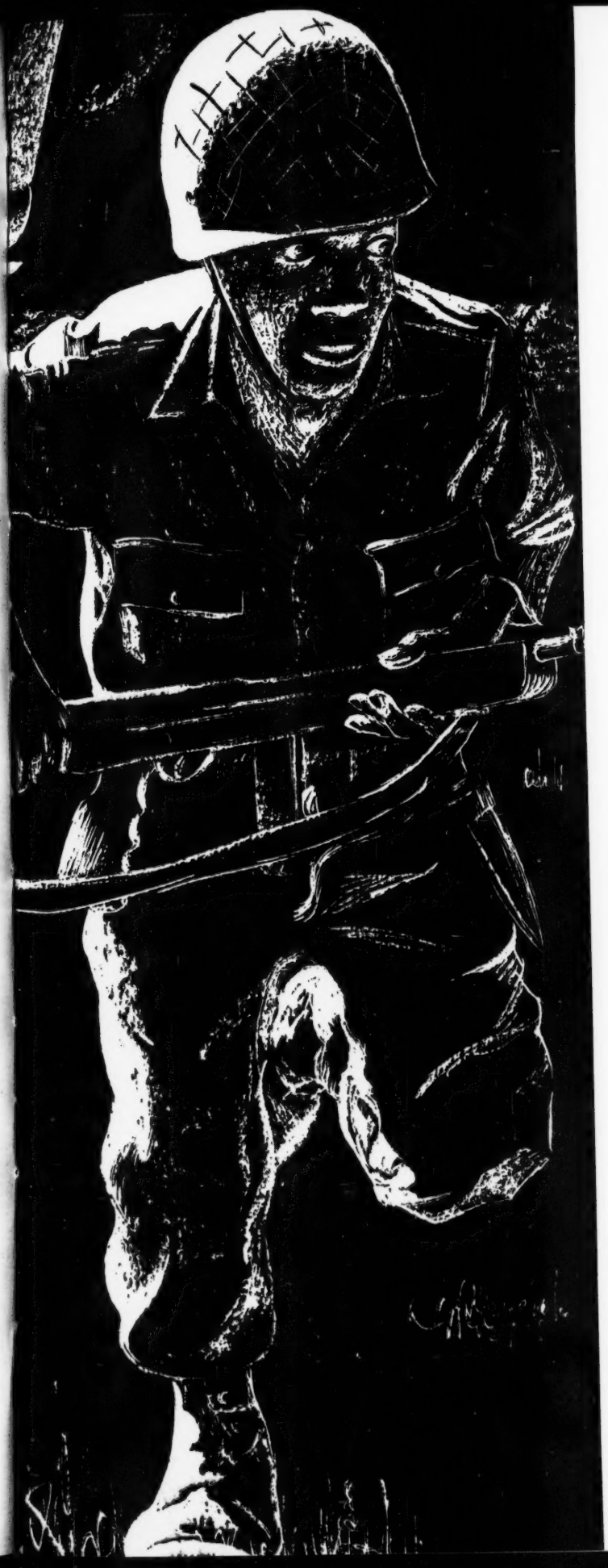

UNITED STATES ARMY
AVIATION DIGEST

page 10

MISSION

OCTOBER 1964

UNITED STATES ARMY AVIATION DIGEST

OCTOBER 1964 VOLUME 10 NUMBER 10

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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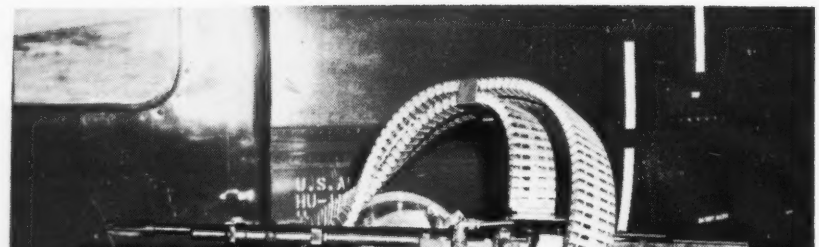
THE M-6E3 WEAPONS SYSTEM

Lieutenant Colonel Harmon Howard

IN WORLD WAR I, the friendly wave and the rocking of wings between aviators on opposing sides of the deadly war on the ground ended when that first aviator started firing a pistol from his open cockpit. From that first pistol shot to arming the fragile aircraft with machineguns for aerial engagement and ground targets was a short step.

Ground troops on both sides soon learned to recognize the enemy machines and take cover from their bombs and bullets. It took no great military decision to fire back at this new tormenting weapon of warfare, yet the fragile machines survived and increased in numbers and usefulness in warfare. Such is the case in the Republic of Vietnam some 45 years later.

Even though the helicopters were unarmed at first, they carried the war to the enemy by transporting fresh, armed soldiers into previously inaccessible areas. It soon became obvious that the unarmed, heavily loaded cargo-carrying helicopters required protective and suppressive fire support to land



M-6 (7.62mm) machineguns mounted on the UH-1B

WEAPON SYSTEM

Firepower:	2,200 rounds per minute
Flexibility:	140° traverse 75° elevation-depression
Mobility:	Zero to 135 mph cross-country Nap-of-the-earth to mountaintop

in even lightly defended areas. Conventional air strikes prior to the helicopter landing were not eliminating the Viet Cong or deterring them from firing back with every conceivable type of weapon once the air strike was lifted.

The capability for continuous protective and suppressive fire support must accompany the cargo helicopter force into the landing zone. The Army feels that the UH-1 helicopter with the M-6 weapons system has the capability of providing this fire support for the cargo helicopters, and this concept is now being tested.

Lt Col Howard is attending the University of Omaha, Nebraska.

SYSTEM COMPONENTS

The M-6E3 weapons system consists primarily of four M-60C machineguns on two power-operated flexible gun mounts, a sighting station, a control panel, and an ammunition supply. The sighting station provides the gunner in the copilot's seat with the means of directing and firing the machineguns from inside the cockpit. The sight is electrically connected to the servo driven gun mounts and synchronized so the correct relationship between guns and sight are maintained.

When the system is energized, any movement of the sight is followed by the guns. When either pair of guns stops at the inboard limit, and no longer bears on target, the guns on that side will cease to fire. Through the use of the sighting station the gunner may direct the fire of the guns independently of the helicopter attitude. Each gun can be elevated 15°, depressed 60° from the centerline of mast, and deflected 12° inboard and 70° outboard. Both gun mounts contain positive stops which prevent movement of the guns beyond safe limits.

The flexible gun mount provides support for two M-60C (7.62 mm) machineguns and the necessary mechanism for the gunner to position them by use of the sighting station. To feed vertically from top to bottom the guns are mounted on their sides, one above the other. The spent cases and the belt links are ejected downward, away from the aircraft. Each gun is attached to the gun mount by a quick release latch. Hydraulic motors drive both axes of the mount through gear reductions. Power for the hydraulic drive motors is derived from the aircraft hydraulic system.

The control panel consists of the OFF-SAFE-ARMED switch and the selector switch which gives the operator the option of firing upper or lower guns, or all four guns for maximum firepower. Stoppages in the guns can be cleared by recycling the OFF - SAFE - ARMED switch from ARMED to SAFE and back to ARMED. If the gun still fails to fire, the mission may be continued by using the remaining guns until the aircraft can be landed and the malfunction cleared.

To conserve weight, the four M-60C machineguns are stripped of all extraneous ground mount associated parts before being aircraft mounted. The gunner fires the guns by a solenoid-operated trigger mechanism which replaces the manual trigger mechanism group.

Twelve ammunition boxes are used in the UH-1 helicopter installation, three for each gun. Each box contains approximately 500 rounds of ammunition. The boxes are arranged in four rows across the helicopter, in the aft portion of the cargo compartment. Flexible ammunition chutes lead from the boxes to the gun mounts. Ammunition cartridge boosters are located on the mounts to assist the guns in transporting the ammunition through the flexible feed chuting. Electrically driven motors drive a sprocket which pulls the ammunition belts through the chuting. A maximum of 6,720 rounds of ammunition can be loaded in the boxes and the flexible ammunition chutes.

SYSTEM OPERATION

For flexible operation, the gunner must depress a "deadman switch" on the sight grip before the guns will follow the sight. To fire the guns the "deadman switch" is first depressed; the guns are brought to bear on target, then the firing switch on the sight grip is depressed. When the "deadman switch" is released, the guns return to the stowed (centered) position and can be fired from either the pilot or copilot position by depressing a firing switch on the cyclic control.

SYSTEM CAPABILITIES

M-6E3 weapons system is capable of delivering up to 2,200 rounds per minute on target. Effective fire can be delivered on a target without regard to aircraft speed, direction, altitude, angle of bank or attitude. If the gunner is wounded or the flexible capabilities of the system are lost, the pilot can fire the guns from the stowed position by aiming the aircraft. This emergency or secondary method is less effective, but the mission can be continued satisfactorily by a well trained aviator.

Firing machineguns from moving aircraft introduces several complicating factors. The aircraft is in motion, the guns move in relation to the aircraft, and the target could also be moving. Each of these conditions requires compensatory adjustments in sighting to bring accurate fire on the target.

When it is necessary to bring fire on a target while the aircraft is in a turn, the condition may be further complicated. A well trained gunner can determine the magnitude of the errors and apply almost instantaneous corrections to his sight picture to hit point (10 ft. sq.) and area targets. The maximum effective range of the system is approximately 750 meters due to the limitation of visual fire adjustment, tracer burn out, and aircraft movement errors.

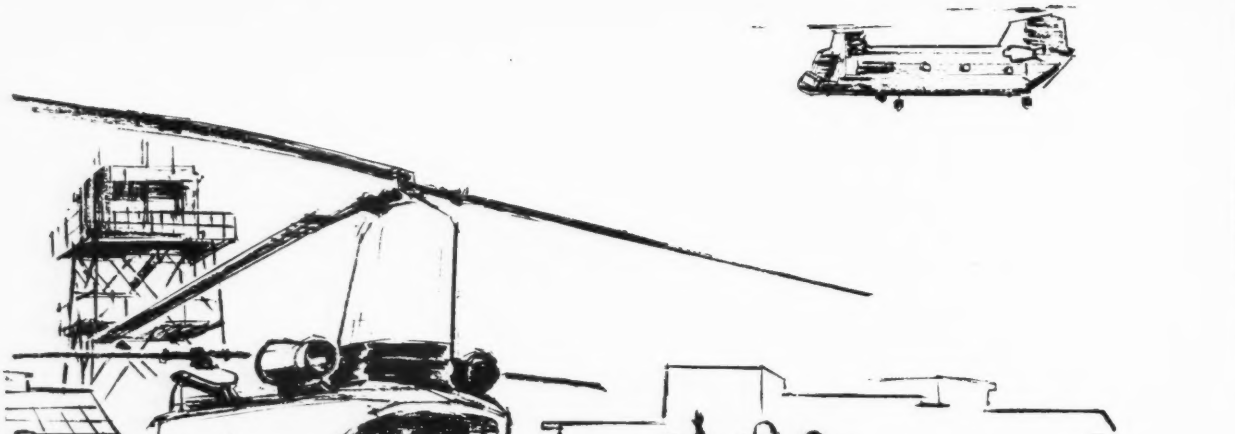
The M-6 weapons system is a light weapons system which can be used to attack soft targets in unprepared, lightly defended positions. It does this job extremely well (even though it is only a beginning in rotary wing armament).

A team of two helicopters using a tactical variation of the traffic pattern (orbiting fire) could maintain almost constant fire on a target and at the same time maintain 80 knots airspeed.

The enemy on the ground will soon learn that this slow, fragile machine is not a machine to wave at, even though it is pointed in another direction. This system is now in use in the Republic of Vietnam, and the Viet Cong are finding it a peculiar and tormenting machine. It appears to fire from almost any direction, delivering devastatingly accurate fire. It plays hide and seek with hills, valleys, streams, and trees, appearing suddenly and rapidly from unexpected areas.

The M-6E3 weapons system has more than proved its worth if it suppresses enemy fire to allow cargo helicopters to complete their missions. It ensures that other cargo helicopter pilots can say as some have, "I wouldn't be here today if it had not been for those armed Hueys."

Orbiting fire from M-6E3 weapons system permits transport helicopter operations to function with maximum protection



Some Broad Safety Concepts

Newton T. Saye

THE U. S. ARMY Safety Program presents so many facets, ramifications, and variables that no single article or series of articles could present a total safety concept. We can, however, recognize several fundamentals inherent in all situations.

One premise must be established emphatically: safety directly relates to "before the fact" accident prevention. To achieve safety, accidents must *not* occur. Accidents don't just happen; people cause them.

Accidents vary — an explosion in a paint shop, a tie caught in a lathe, brake failure on a personnel carrier resulting in a rollover, a fire in a BOQ, or a wing separating from an aircraft in flight. Each of these accidents was the result of human error.

Electrical wiring in the paint shop had not been inspected in over a year, and worn insulation caused a short and electrical sparks while spray painting was underway. Supervisory error.

The lathe operator was instructed not to wear loose clothing, but due to vanity did. Operational personnel error.

Brake failure occurred due to a chafing hydraulic line which wore through. Inspection error.

Mr. Saye is Safety Director, U. S. Army Aviation Center, Ft Rucker, Ala.

An officer went to sleep in the BOQ with a cigarette still burning. Human error in personal habits and supervisory error because inadequate warnings were posted and bedding had not been made fire resistant.

Wing failure of the aircraft might first appear to be pilot error due to exceeding the g limit yield factor. However, in this case a great deal of care should be exercised to determine if the pilot was adequately trained and physiologically and psychologically prepared for the flight. Poor maintenance or previous stress might have contributed, or fundamental design error may have been the cause. Any of these is some form of human error.

If accidents are to be prevented and we are satisfied that people are the cause, what is the solution? Stop people from causing accidents. A step in this direction is to educate people to *want* to stop having accidents. Very few people really want to have an accident, but this is a negative or inactive reaction to the problem. We must create in the people a desire to prevent accidents in a positive and active way.

All safety programs have particular problems but the safety program of the U. S. Army presents unique problems due to the nature of the Army's mission. Our men are trained to keep peace through the ability to make war. Learning how to make war breeds an atmosphere for accidents. Life in the field is elemental. Troops are required to handle explosives and weapons of all kinds, to operate in all types of unimproved terrain, and sometimes to forego normally acceptable safety practices. The Army Aviation Program is exceptional in its environment, sometimes operating from near impossible areas.

With the problems, criteria, and conditions stated, prevention of accidents requires a broad program. These points should be covered:

- Create a safety education program which reaches each individual in all echelons.
- Provide and issue orders, directives, literature, posters, film, and any other media which reinforces safety education.
- Cause an interchange and interaction of safety ideas throughout all echelons and publicize these, giving credit where indicated.
- Create an inspection program which adequately inspects *all* areas, including both those in which hazard is inherent and those in which hazard can breed.
- Firmly enforce existing safety releases, regulations and directives. Create and recommend for adoption others that may be required.
- Organize and make function a superior "after the fact" accident investigation program to determine the cause of accidents which have occurred in order to make recommendations for prevention of similar accidents in the future.
- Inculcate in supervisors the desire and need to stop accidents in order that their own job performance will improve through more efficient and less costly operation.
- Create an adequate communication system to distribute safety information, accident causes, preventive information, and to promote interchange of safety ideas in the field.
- Work closely with national, state, and local law enforcement and safety organizations for interaction of ideas and enforcement practices.
- Charge all personnel to be alert to accident breeders, communicate these dangers, and bring recognition for hazardous jobs safely performed.
- Require all safety personnel to work constantly with operational and training activities so that pertinent jobs and related hazards are thoroughly understood.
- Re-educate, reinforce, and remotivate each individual in all echelons constantly.

Each of these steps requires a broad conceptual scope of its own which will need further detailing.

Broadly speaking aviation presents all of those problems and remedial concepts and in addition the personal, physiological, and psychological problems inherent to airmen. More critical design characteristics of aviation equipment compound these problems. The addition of aviation requires at least four more steps in a safety program.

1. Close liaison with aviation medicine and distribution of aviation medicine information.

2. Study and recommendation of aircraft design, flight instruction, and air navigation criteria.

3. Creation of a special type investigation board and inspection team consisting of highly qualified and RATED personnel.

4. Maintenance of a widespread and rapid communication system so accident cause potentials can reach all concerned people immediately.

To summarize, any safety program hinges on accident prevention. People make accidents, and to stop accidents we must take certain steps. The most important essentials of these steps appear to be education, communication, and interaction. People directly responsible for safety must be ever alert to new ideas, new methods, and hazards in unsuspecting places. They must look, listen, think, council, be constantly in the process of becoming better safety educated; and in turn they must communicate with and educate toward safety.

How serious is your approach to survival training? Are you prepared to face the hazards of terrain and weather. More important, do you have the

Will To Live

Captain John H. Maguire

Capt Maguire is Branch Chief, Rotary Wing, IMD, Dept of Maintenance, USAAVNS, Ft Rucker, Ala.

AS THE OBSERVER and I sat in the darkness by a plane with its belly pointing to the sky, I pondered how I had gotten here and why. We could hear the jungle noises all around us. I suspected that in the days to follow I would have plenty of time to think about a lot of things, including how to get out of here alive. But right now I was wondering what error I had committed that had brought me here.

I began thinking back to that morning when I reported to the hangar for the briefing. I remembered being assigned to a search area and meeting my observer. I left to file my flight plan, and while I filed, I joined a discussion on how to fly a search pattern. While preflighting the O-1A, I noticed the survival gear in the baggage compartment. I did not inventory the gear, just saw some back there. The runup and takeoff were normal. Thus, I was off to look for a missing Panamanian civilian aircraft that had two women and three children aboard.

The flight to the area was normal in all respects, although the clouds were hanging on the tops of the hills. The bases of the clouds were about 2,400 feet and circumnavigation was required to arrive in the search area. I reported to the unit radio station upon entering my area, then repositioned the radio selector to intercom for conversation between the observer and myself.

I was slow flying with about 20° flaps, indicating 70 mph at about 2,200 feet indicated altitude, and approaching a 1,900-foot ridge, 90° to the ridgeline. I was searching the right side of the flight line and my observer was searching the left side. The aircraft flew into a downdraft, and even with full throttle the rate of descent increased. The ridge was so steep that turning room was not available. With full power and full flaps applied, I landed the aircraft on top of a tree. The aircraft rolled to the right on its longitudinal axis and fell to the jungle floor, a distance of approximately 200 feet.

The plane hit the ground on its right wing and rolled upside down. I was momentarily stunned and the observer was dazed. When I came to my senses, an electrical fire was starting under the instrument panel. I flipped off the battery switch and the fire stopped. We climbed out and slid down the wing. I had cut my head on the compass and was still dazed. Flight helmets, which had not yet been issued to my unit, would have been a welcome protection.

The observer came out of the aircraft first and started off to find a cleared area. I stopped him and we searched for the survival gear and salvaged the wreck for usable parts. Gasoline was draining out the right wingtip and the battery was smashed. The oil was not accessible as the engine was buried in the ground.

I told the observer to start a fire while I planned our course of action. After plotting our position on the map and measuring the distance, I inventoried our supplies and made a terrain study. We had ten cans of emergency water and two cans of survival rations. The emergency radio could not be found. We were located on a 75° slope which appeared to be 1,500 feet above the valley. This indicated the relative position of water.

The weather got worse; rain started to fall an hour after we crashed. A fire proved to be impossible to start, even using the night side of a day-night flare on gasoline soaked wood. The atmosphere under the huge trees was dense, moisture laden, and had no movement, so the fire was smothered by its own combustion.

A camp site proved impossible to establish on the hillside, as the saplings around the larger trees weren't rooted sufficiently deep to allow the parahammocks to be set up between them. So we spent the night in the aircraft, to escape the continuous rain. The next morning, we started cutting trees and set up smoke flares on high poles in our area. About 0930 a UH-19 passed ¼ mile away, but the pilot didn't see us as the flares failed to ignite and we didn't have an emergency radio. Since we had managed to clear a hole in the vegetation about 150 by 400 feet, we hoped we had been seen. Thinking that the helicopter would be back, I decided we would wait until noon for its return and then start walking out. Soon we would have to obtain additional water.

We heard another aircraft and tried to fire the wreck, but the gasoline had evaporated and it was impossible to start a fire. When noon arrived, we spread the parachutes over the wreck, shouldered our packs, and started on our way. We took our lifevests, food, survival tools, para-

chute riser cords, and our remaining water.

Following a wash near the scene, we proceeded down the hill. We traveled the nearly vertical slope with the aid of our riser cords, slip-knotted to strong trees. After descending 1,200 feet we came upon a small stream. Looking back up the hill, we realized it would be impossible to return to the wreck, so we continued walking.

The stream became wider and we came to a waterfall with undercut sides. Because there wasn't an easy way around the falls, we securely tied riser cord to a large tree and went straight over the falls. The drop was 35 feet. We continued downhill until 1745. The stream was surrounded by a dense growth of saplings without any breaks, so when we came to a flat rock in the stream we stopped and spent the night.

Being tired and disheartened after the morning's near-rescue and the long march, we didn't talk much. The observer developed a sore mouth from iodized water and couldn't eat the survival candy. I made him some well sugared tea. Then after checking our feet, we went to sleep.

The following morning, we started downstream at daybreak and were doing rather well until about 0900 when two civilian aircraft flew by. They circled and flew back over us. We thought they had seen us, but they flew off without acknowledging our signals. This was the death blow to our hopes.

We walked on downstream, becoming increasingly depressed. Our strength was declining along with our spirits, and little obstacles grew to be insurmountable ones. The presence of a pebble stream bed with steeply sloped sides covered by dense vegetation and increasingly deeper water caused our walking to become a stumbling, lurching series of painful falls.

The alignment of the river tended to produce a hypnotic effect and we walked as in a dream world. I vividly saw my 10-month-old son walking before me, leading me to my wife who resided at the top of each slope where the stream turned or twisted. My observer's wife, who had just returned from the hospital, was due to have her baby in a month. She resided in Panama City, Republic of Panama, and he was anxious about her.

Two events which happened about the same time saved us from ourselves. The observer's boots came apart and a gravel bar presented itself. Here we stopped and spent the remainder of that day and night. We ate and then, while my observer sewed up his boots with nylon string from the riser cord, we exchanged life histories and discussed the sensations we had experienced.

We tried to lose our shyness and natural inhibitions against laying our innermost thoughts bare to critical analysis by another person. Gradually we exchanged thoughts on religion and said a series of psalms and an impromptu prayer. Then we felt better and planned the next day and succeeding days. Our equipment was analyzed and another series of deletions was made.

The following morning I got up refreshed, completely convinced that a force stronger than my will was at work. This is a startling realization, making you feel humble and weak, yet strong and sure in your decisions.

Upon awakening we washed, shaved, ate, and proceeded on our way. We wore our lifevests deflated and as we came to a deep pool in the stream, blew them up and floated across. The river alignment straightened out somewhat and the pools became deeper and wider.

After 5 hours of walking, we came upon a deserted Indian hunting camp complete with hut, fireplace, and dry wood. About this time we heard an aircraft engine and ran for the stream bed. Two helicopters came over in formation and spotted us. The walk was over.

One pilot dropped his lunch and we devoured it. We were picked up by two OH-13s, then transferred to a UH-19, which returned us home. The remainder was anticlimatic, i.e., welcome by the unit, the pictures and the TV interview. The relief on our families' faces and their welcome home completely rewarded our determination to exert ourselves beyond normal limits of endurance again if the need should arise.

* * *

Fliers are an optimistic group of individuals. To varying degrees we kick the tire and light the fire day in and day out without a thought to survival or escape and evasion. We are comfortable in our easy chair and smooth riding car, and confident in our own capabilities. Each of us is to a degree fatalistic, realistic and, above all, individualistic. All of us have at one time or another been exposed to survival and escape and evasion training. But did we play the game or take a pocket full of candy bars to eat? Put yourself in the place of these men and decide what you would have done.

In survival situations, the crew and passengers of aircraft should normally stay with the aircraft. There are exceptions, and this is one. Whenever the aircraft is concealed from aerial observation, the crew should attempt to get in the open or walk out.—Editor

TRANSIENT FACILITIES

Major John H. Salm, Jr.

WHERE ARE we going to file to in the San Francisco area?"

"How about Grim?"*

"You out of your mind? Let's go to Alameda."

Why do transient Army Aviators avoid some Army installations like the plague when planning RONs or cross-country flights? Because many Army installations offer the poorest transient facilities of all the services. In my experience, Air Force, Navy, and Marine facilities are vastly superior to those offered by the Army. Not only is the service better but the conscientious attitude of flight line and operations personnel is also outstanding.

A cross-country trip to San Francisco was a good example of disparity of facilities and services. On arrival at Alameda NAS at 0200 hours on a Saturday we were parked, chocked, tied down, and given transportation to flight line operations. After completing arrangements for refueling we were next taken to the transient BOQ. Here, we were assigned rooms, given towels, soap, and bedded down for the night.

About 0800 hours the next morning we ate a hearty breakfast at the Officers' Mess — steak and eggs, 90¢ — and were airborne and on our way to Grim by 1000 hours. Our arrival there was a little less auspicious. After we landed, taxied around looking for a place to park, and tied down the aircraft, we walked to the operations building. There we were greeted by an enlisted man in a T-shirt with his feet on a desk, who asked if he could help us. Well not really — since we'd already managed to get this far without any assistance.

Several telephone calls failed to provide us with accommodations at Army installations in the area, so we decided to return to Alameda. At Alameda we were again afforded accommodations, and on our departure the following day we were provided with delicious inflight lunches for a minimum charge.

It is not my intention to designate Grim as a whipping boy. Unsatisfactory conditions at other Army airfields could be related, but this one generalizes the existing situation. In defense of Army accommodations and service some will argue that flying is not our primary mission, that we don't have the number of transient aircraft to warrant this type of service.

Perhaps this is true; however, a deplorable situation exists and should be remedied. A few steps in the right direction would be:

Instill a courteous, helpful attitude in those personnel who will come in contact with transients. The cliche "a first impression is a lasting one" is extremely appropriate.

Cross-train available personnel so they are aware of the fuel and oil requirements of various aircraft.

If service is not available on a 24-hour basis, assure that it is publicized in NOTAMs, sectional charts, and through other effective media. Where 24-hour service is *indicated* ensure that it is available. Many installations indicate 24-hour service when, in effect, it does not exist. Refueling of aircraft on weekends is unusual and emergency maintenance is out of the question.

Proper police of passenger lounges, operations offices, and flight line add to a favorable impression.

Ensure that alert personnel are in proper uniform and are instructed in fundamentals of military courtesy.

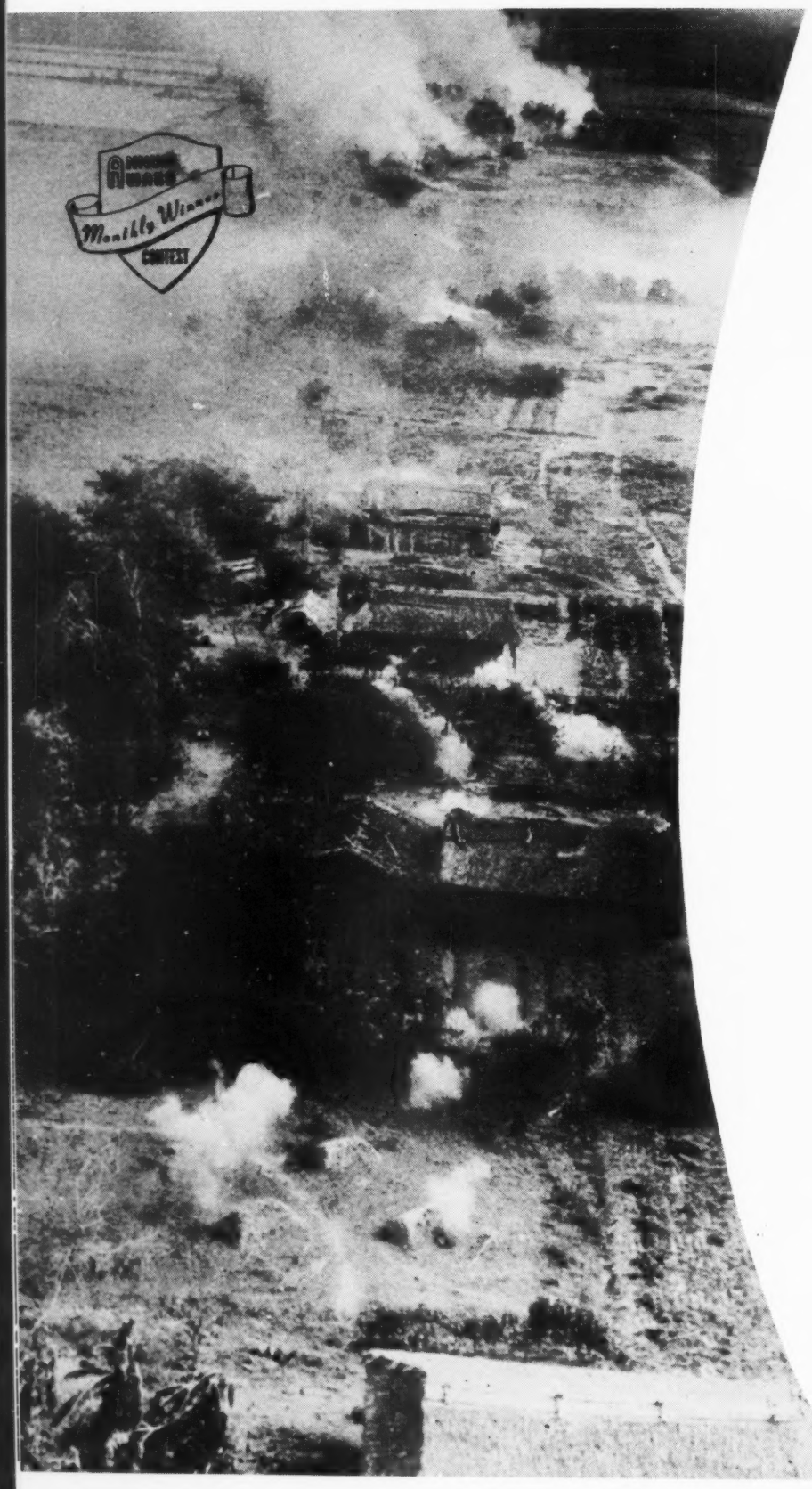
Brief operations personnel, charge of quarters, or whoever may be in charge during off-duty hours, on procedures to be followed.

Implement an SOP for transient aircraft.

Let's institute a conscientious program to improve hospitality and service.

**A pseudonym to protect the guilty.*

Maj Salm is aide de camp to the Commanding General, USAAVNC, Ft Rucker, Ala.



Lieutenant Chadwick C. Payne

A SILENCE fell over the milling crews as the company commander entered the door at the rear of the briefing room. He walked directly to the front of the assembled crews and turned to face them. His face was hard as he spoke.

"At 0700 hours this morning we will conduct a heliborne assault on this area." He punctuated the statement with a finger on the large map to his left rear. He continued with, "The area is in heavily infested Viet Cong territory. There are plenty of automatic weapons in the area, so listen to this briefing. Operations officer!"

The major stepped aside and sat down as the operations officer came forward with the details, thoroughly thought out. The briefing concluded with instructions for escape and evasion.

"If you go down, the ship behind you will pick you up. If he can't reach you, proceed west to the road here." He pointed out the road on the large map. "Stay in the jungle until you get there. We'll keep a fire team of armed ships with you as long as we can."

Lt Payne is a member of the Armed Helicopter Platoon, 118th Aviation Company (Air Mbl Lt), APO 27, U. S. Forces.

MISSION

The major again spoke as he arose from his chair. "This one can be tough if we don't stay alert. Remember to call fire if you receive any, and mark it with smoke grenades. That's all."

The crews gathered in little knots for a few last minute coordinating instructions, then went outside into the dark to board the awaiting transportation. The ride to the flight line was a bumpy one. Faces were lit occasionally by someone taking a deep drag on a cigarette.

The truck halted by each helicopter as the crew jumped out. Low voices were heard up and down the darkened flight line. An occasional flashlight beam indicated a preflight inspection in progress.

Crews donned flak vests and made last minute checks of personal weapons, then took their places aboard the aircraft as the appointed time for departure approached. The line became a dark stillness.

The quiet was broken by the whine of a turbine engine winding up, joined almost immediately by several others. The whine soon built up to a crescendo of engine rpm and of turning rotor blades. Formation lights flickered on up and down the line. Grim but confident faces appeared in the red glare of instrument lights.

The uniform roar of engines and rotor blades was interrupted by the crackling of radios as communication c h e c k s were completed. "Alpha One to Alpha Two, UHF check." "Delta One to Delta Two, commo check completed."

Finally a voice crackles, "Line 'em up."

The aircraft move out in groups of three, lights eerily making rotor blades glow as they hover to the runway and sit down in a column of V's.

Seconds later, the escort helicopters come alongside, rockets and machineguns hanging from them. The team is ready.

The CO's voice breaks into individual thoughts! "Pull pitch 30 seconds." Gloved hands make last minute adjustments and the 18 helicopters rise and climb into the early morning sky. The sun, not yet in sight, creates a red glow in the east. The sky is filled with red, green, and yellow lights — like a technicolor collection of fireflies.

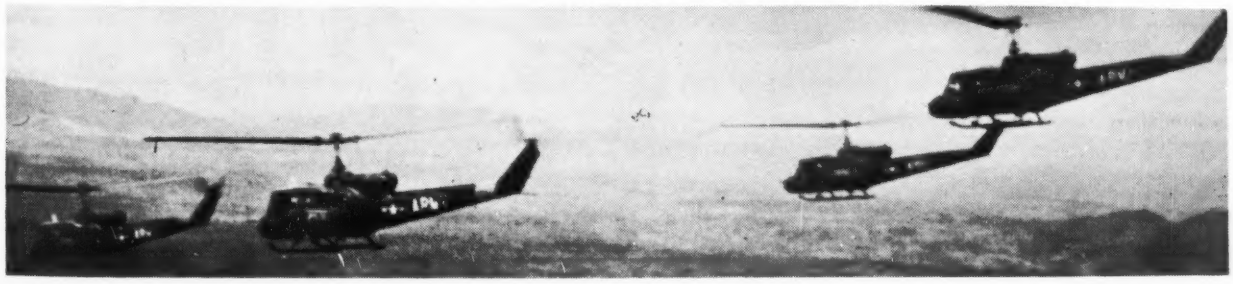
With every passing moment the sky grows lighter as the sun climbs steadily over the dark rim of the horizon. Pilots concentrate on the myriad dials and gauges in front of them. Except for the next aircraft in the formation, their whole world is in the cockpit. Their headsets are the only link with the outside.

Crewchiefs and gunners also live in a different world. Theirs is a world of jungle passing beneath, and p r o b a b l e hiding places for Viet Cong antiaircraft positions. Their eyes fixed on the jungle below, they search for telltale flashes and puffs of smoke.

The loading zone appears in the half-light of the climbing sun. Lines of awaiting Vietnamese troops appear as the helicopters near the tiny dirt airstrip.

Upon landing the now unnecessary navigation lights go out, and rotor blades slow to a standstill. Fuel trucks move down the line of helicopters, topping off tanks, and crews step away to light cigarettes.

A controlling O-1D is circling



lazily overhead as the pilot relays to the ground messages received from the combat operations center (COC) back in Saigon.

As the fuel truck pulls away from the last helicopter, the crews board their aircraft. Engines again whine as the tough little Vietnamese troops crowd aboard the aircraft, laden with weapons, ammunition, and packs filled with rice. Blackened little pots used for cooking hang from their packs as they jam themselves into cargo compartments, ten bodies (including two American gunners) in a 7′ by 4½′ area.

Again the radio crackles and aircraft lift off the runway. This time, the next stop will be a small clearing in the Viet Cong infested jungle. No friendly faces will be waiting there.

As the flight cruises over the jungle the aircraft constantly adjust positions in the formation. Mild turbulence marks the sky with small clouds, and the closely packed helicopters move through the air as one. Sweat drips from inside the hot helmets. Although it is early morning, the mercury is surging upward toward a temperature forecast to be a blistering 90°.

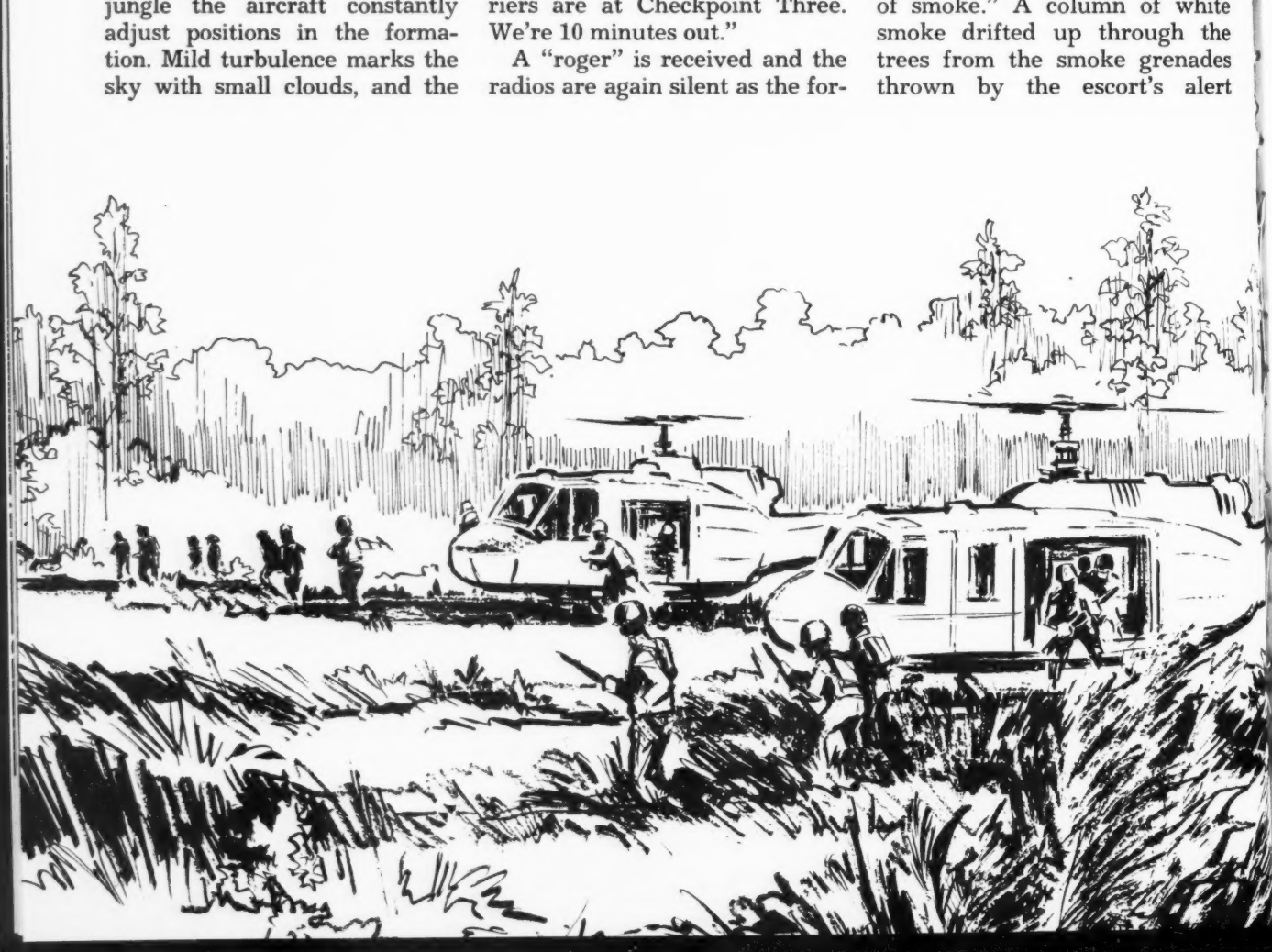
A tall column of smoke appears on the horizon. Tiny black specks move around white pillars as Vietnamese A-1-H's bomb and strafe the landing zone. Pilots remember seeing the faces of those crews at the briefing. As soon as they had been notified, the Vietnamese Air Force (VNAF) had their crews meet with the Army unit involved in the mission. Details had been hashed out and the Air Force people knew every phase of the operation. The Army unit commander was now talking to the Air Force flight leader on the radio. "Jungle Jim, this is Thunderbird Six. The troop carriers are at Checkpoint Three. We're 10 minutes out."

A "roger" is received and the radios are again silent as the formation of helicopters approach the landing zone.

Minutes later the landing zone comes into view. It is exactly as it had appeared in the aerial photos taken by the Mohawks the day before. Each detail appears the same.

The silence is broken as the major calls the VNAF. The helicopters are only a few seconds out now. The VNAF lifts its fire as the armed escort helicopters speed ahead of the formation into the landing zone. They form two daisy chains, one on each side of the landing zone as the troop laden transport helicopters approach their touchdown points. The escorts chatter, returning enemy fire received from the periphery of the landing zone.

The radio comes to life. "Bandit Three-One receiving automatic fire 100 yards southwest of smoke." A column of white smoke drifted up through the trees from the smoke grenades thrown by the escort's alert



gunner. The escort immediately behind the marking aircraft puts heavy machinegun fire into the area. Then the air seems to roar as he fires rockets.

The ground fire becomes intense as the troop carriers touch down. The Vietnamese troops pour out, separating and firing toward the enemy positions as they move. Crewchiefs and gunners fire from the now empty doors of the transport ships as they lift as one from the landing zone.

Armed escorts break off firing passes and pull up alongside the transport ships, firing suppressive fire into the jungle beneath the departure route as the flight climbs to altitude.

The sounds of the fight taper off as the aircraft gain altitude. At 1,500 feet the flight levels off. At this altitude the effectiveness of the Viet Cong fire decreases considerably. At contour level, the jungle comes alive with small arms fire.

The radio crackles again as the controller in the O-1D aircraft informs the loading zone controller of the flight position. The loading zone will be ready now. The aircraft will refuel, the escorts will rearm, and the second lift will load its troops. The whole pattern will begin again, except for the VNAF prestrike and the suppressive fire from the helicopters on approach to the landing zone. The whole loading zone buzzes with activity directed by the control party as the plan unfolds.

Each helicopter has its load arranged neatly by its touchdown point. Vietnamese troops are waiting for the transport ships, and ammunition is laid out for the escorts. Each crew begins preparing for the next lift as soon as its helicopter touches down. Quick checks for bullet holes, distribution of individual ammunition, and a quick crew check by the pilot ensure readiness for the next lift.

As fuel trucks move down the line of helicopters, crews load machineguns, rockets, and rifles — and hot coffee is passed around.

Preparations c o m p l e t e, the crews walk back to their aircraft, put on flak vests, adjust seats, untie rotor blades, and standby, ready to start.

The crews had been instructed exactly where each aircraft would be in the loading zone, the formation, and in the landing zone. Each crew member knows his job and repetition has made it habitually perfect. Upon landing, aircraft had been inspected for bullet holes and other damages. So far, no hits.

The blades on the lead aircraft begin to turn. Soon the others are turning and the radio again comes to life. It now tells them to "Pull pitch; 30 seconds."

The escorts wait until the troop carriers are in the air, then take off and join them, below and to the outside of the formation.

The gunners of the escorts sit

poised in the helicopter doors. Smoke grenades for marking enemy fire are in their hands, the M-14 rifles are in their hands. They watch every possible hiding place as if their life depended on it, which it does. The pilots can tell when a gunner speaks because the air from the open cargo door rushes around the gunner's microphone.

The r u s h i n g noise comes through to the pilot now as a gunner suddenly reports enemy fire, quickly pulls the pin of his smoke grenade and throws. Then his M-14 chatters. Tracers mark the target. The escort behind the ship that marked the fire engages the target as the formation passes over. Never does an escort break from the formation. Suppressive fires are put on the area as each escort passes over.

As the landing zone appears and the troop carriers start their approach through the turbulent air created by the proceeding aircraft, the lead armed escorts move ahead into the landing zone. This time they will not fire unless fired upon. The first load of Vietnamese troops is still on the edges of the landing zone, fighting hard.

As the armed helicopters pass the end of the landing zone they turned 180° away from the LZ, reconnoitering parallel to the direction of landing but in the opposite direction. When they reach the approach end, they will turn again to fly alongside the transport ships preparing to lift off from the landing zone.

As the second escort in the daisy chain on the left turns, a crack is heard, then several more cracks. The pop of a smoke grenade fuse is heard and again the M-14 chatters. The gunner reports fire in the tallest patch of trees west of the smoke, about 50 meters.

The pilot relays the report, and the next ship in the daisy chain engages the target. Rockets are heard thumping away at the jungle beneath as the crewchief of the first ship reports a hole in the bulkhead behind the copilot's seat.

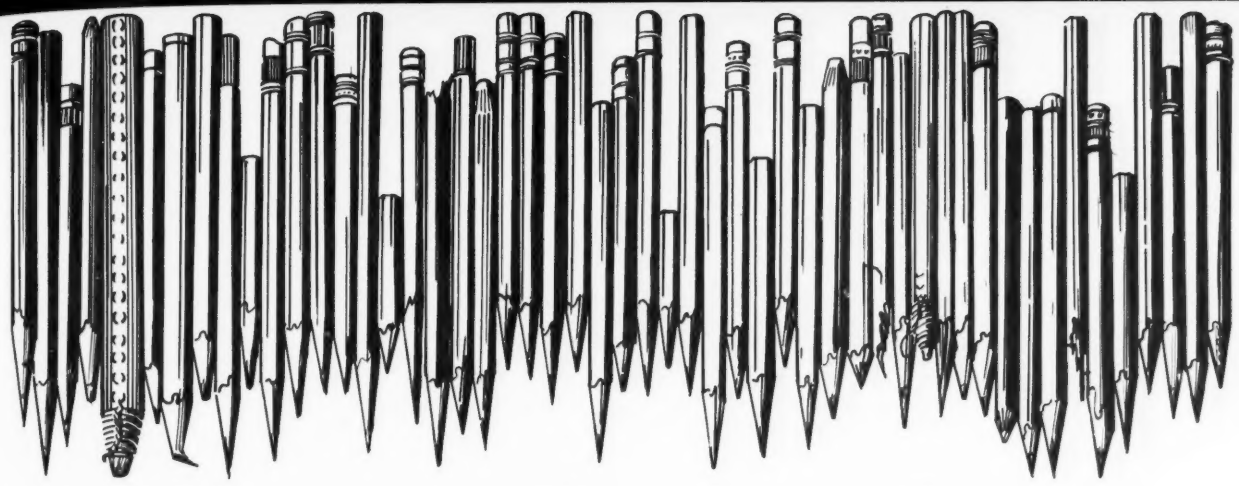
Each ship in the daisy chain puts fire on the target. Machineguns search out the target, fix it, then rockets rush ahead to destroy it. The area is engaged and the invisible enemy in the jungle below is neutralized. Whether he was alone or one of several, whether he ran or was killed or wounded, will probably never be known unless the ground troops find him and report it. The Viet Cong always hide their dead when they have time.

By this time the transport ships are off again and the escorts disengage and join up. This is the last lift. They're through for the day.

The flight home is a lonely one. Everyone is tired. The mission lasted 5 hours. It involved 3 hours of flying time, but the tension of being subjected to enemy fire and of flying an aircraft, heavily loaded, in a high density altitude into a tight jungle clearing, boiling with rotorwash is overwhelming. Soon the home field comes into sight. The formation suddenly tightens up and looks neater, without a word being spoken.

After landing, filling out necessary reports, checking aircraft for damage, and the briefing, the crews adjourn. It was a good mission.

Each mission of this type involves hours of planning and coordinating. Aerial photos of the landing zone are required. Reconnaissance of the loading zone is necessary. Fuel and ammunition must be planned and provided for as well as personnel to handle them. Airfield control teams must be briefed, aid stations established, recovery teams organized, fighter and bomber crews briefed, and Vietnamese ground commanders have to be consulted. The big payoff is when the mission is accomplished and everyone returns to home plate without casualties.



Equipment Records System

Captain J. O. Weight

A VAST, all-encompassing system for maintenance management and equipment records is here. The system reaches all units within the Army scattered over the entire world. Information concerning the operational status of each unit and its equipment is now being reported and evaluated. The recent implementation of the field command element of the system allows machine processing of all information reported by the equipment records system. This represents a major milestone in maintenance management. Three elements compose the system: the operational units, field commands and national agencies.

The first element of the system was introduced as TAPER (The Army Plan for Equipment Records). It is no longer a plan, however, and the name has been changed to TAERS (The Army Equipment Records System). TM 38-750 outlines the procedures for the records system used by the operational units and their support activities. The TM also contains information as to which forms and records are required on all the various items of equipment in the Army inventory. The equipment records system at the operational units is now operating smoothly. It represents the completion of phase I of the entire system.

The field command element was implemented on 1 January of this year. This initiated phase II of the overall system and is as much a revolutionary change at the field command level as TAPER was at the operational unit level. This element was designed for use at the division and installation level, with TM 38-750-1 outlining the procedures for its operation. Here, maintenance data reported by the operational units will be machine processed, evaluated, and given to the division or installation commander. It will then be possible for them to determine the operational status of their units and equipment. Also, commanders will be provided sufficient information to exercise efficient management of their maintenance activities.

The third element in the system, national agencies, is scheduled for implementation as phase III in January 1965. TM 38-750-2, currently in draft form, will outline the procedures to be used at the national agencies. Here, maintenance data will be compiled, analyzed, and stored. It will be used by command at the national level to evaluate readiness status, performance, and needs for maintenance resources. It will be used by commodity managers to identify inventories and plan procurement of parts and major items of equipment.

SYSTEM DEVELOPMENT — WHY?

The Maintenance Board, located at Fort Knox, developed the Maintenance Management System in view of the Department of Army's Operation ARM (Army Ready Materiel). ARM is the Army's highest priority peacetime function. Its objective is to attain and maintain a combat operational status of equipment sufficient for units to accomplish their assigned missions in accordance with operational

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Capt Weight has had extensive experience in forms and records management. He is currently attending the University of Omaha, Nebraska.

and contingency plans. This is a tremendous objective when considered in light of the ever increasing technological development of equipment for the Army and the fantastic range of environmental conditions over which this highly complex equipment must operate.

To achieve the ultimate objective of material readiness, a means had to be developed for collecting information concerning the operational status of equipment. Also, information concerning the needs for maintenance resources had to be collected and evaluated. Information on operational status is required to determine when equipment meets operational standards. If it does not, then information on maintenance resources is required to determine why the equipment falls short of the desired standards. Then, the particular resource required must be provided to bring the equipment up to standard. Maintenance resources include: sufficient time for maintenance, sufficient funds and personnel to operate maintenance activities, and physical materiel such as tools, maintenance floats, training floats, parts and end items of equipment.

The Maintenance Management and Equipment Records System provides the means for collecting and evaluating the required information. The results will be made available to commanders from company level to Department of Army, making it possible to determine the operational status of equipment and effectively manage maintenance activities.

The system will feel the pulse of maintenance operation over the entire world. When deficiencies are detected, the system will diagnose the trouble and prescribe the proper treatment to bring its patient — maintenance of equipment — up to standard.

REPORTING DATA — HOW?

The equipment records, kept in the equipment logbooks, contain the source data for the reporting documents. Information to be reported on aircraft will be taken from the logbook records and placed on DA Forms 2410, 2408-7, 2408-8 or 2407, whichever is applicable. These forms are now being processed and the data from them evaluated at division and installation level. However, the system will require two additional reports which will be made on DA Forms 2408-3 and 2406. Procedures for these reports will be contained in a new, revised TM 38-750 to be published in the near future.

DA Form 2408-3 will be used to report all completed second echelon maintenance performed on major items of equipment, including all aircraft. Operational status of the particular item of equipment will also be reported on this form. Operational status will be reflected as "Green — fully operational," "Amber — marginally operational," or "Red — nonoperational." Green, amber, or red status will be determined by inspecting the item of equipment and its logbook records. Procedures for this inspection are outlined in the inspections chapter of the applicable equipment TM.

The form will also require most entries to be in coded form so data processing machines can process the information. As usual, the codes will be found on the back of each form, but the date and time will require a little figuring by the mechanic. The Julian date system will be used on this and all other reporting documents. Aircraft time will be entered in hours and tenths of hours on the reporting documents.

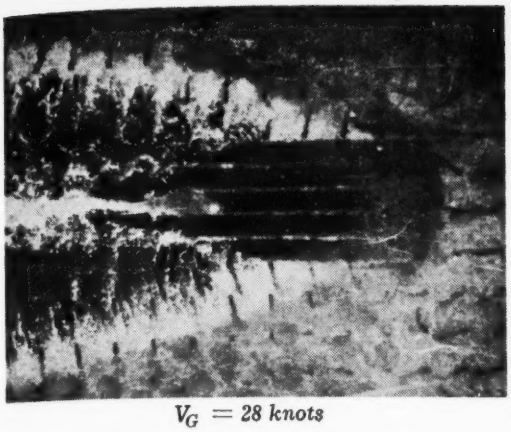
DA Form 2406 will be used to report unit operational status. It will provide, for the Department of Army staff and commanders at all levels, information as to the readiness status of equipment in the hands of the using organizations. Specifically, it requires the amount of equipment authorized, amount on hand, green, amber or red status, reason if red and the number of operational and nonoperational days.

PAPERWORK — A LARGE PART OF MAINTENANCE

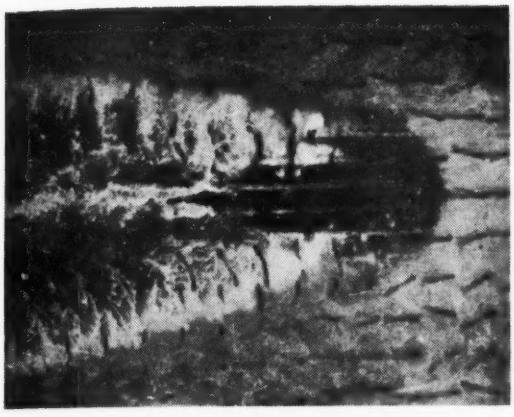
At the using unit level, paperwork is by no means being reduced. Maintenance equipment records have always been required and still are, but in what seems like increasing numbers. TAPER considerably reduced the number of forms required, but did not necessarily reduce the amount of information required. The mechanic still must spend a good deal of time pushing a sharp pencil rather than a wrench. The important thing now, however, is that the mechanic's time is not wasted. The information he records will be sent all the way to the national level where action can be taken on it, rather than have it filed in the maintenance office for 6 months as "cover yourself" type information and then discarded.

Today's Army demands an up-to-date maintenance management system to deal with the multi-complex problems associated with its highly sophisticated equipment. The backbone of maintenance management is the Equipment Records System. In the using organization, the rigid substance of that backbone is the mechanic who knows how to use a sharp pencil as well as a wrench. Without the proper upkeep of equipment records and accurate reports, maintenance operations will collapse.

Direction of motion →



V_G = 28 knots



V_G = 56 knots

V_G = 71 knots

V_G = 88 knots

SLICK AS GLASS

Although it has been known for a long time that the combination of pneumatic tires and wet pavements is dangerous, research to find out why was not started until recently. In 1957, during a tire treadmill study the phenomenon of hydroplaning (tendency of the tire to lift slightly above the surface of the pavement and ride on the water covering) was first noticed and demonstrated. Since then studies on the problem have come fast and furious, but somewhat disorganized.

SLICK AS GLASS is the way some drivers refer to wet, hard-surface roads. There's hardly a driver today who does not know it's necessary to drive slower on these "slick" roads to maintain control. But what does the airplane driver understand about the phenomenon of hydroplaning?

Last year, the National Aeronautics and Space Administration (NASA), worried over the number of aircraft skidding and sliding on wet runways, collected and summarized all available information on the subject and came up with some surprising conclusions.

It was found, for instance, that hydroplaning of pneumatic tires occurs on wet runways when the aircraft reaches a speed at which hydrodynamic* pressures lift the tires from the pavement and allow molecules of water to come between the surfaces of the tire and the road. These molecules then make a very efficient lubricant.

Left: Photographs of 20 x 4.4 aircraft tire on glass runway at NASA track under partial and total hydroplaning conditions. Vertical load = 500 lb; tire pressure = 30 lb/sq in; water depth = 0.5 inch. V_G = groundspeed in knots.

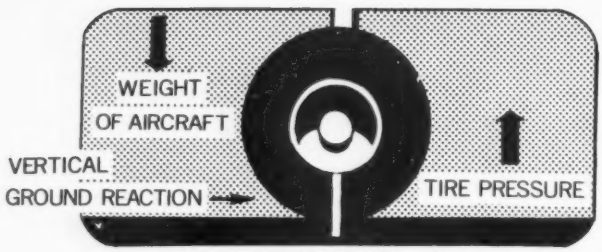


Figure 1. Standing tire

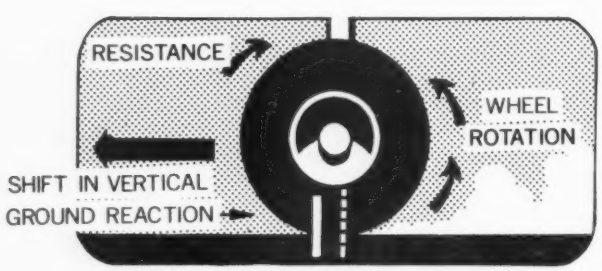


Figure 2. Rolling tire, dry pavement

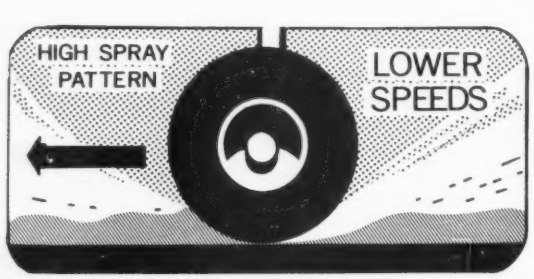


Figure 3. Tire contact with deep fluid

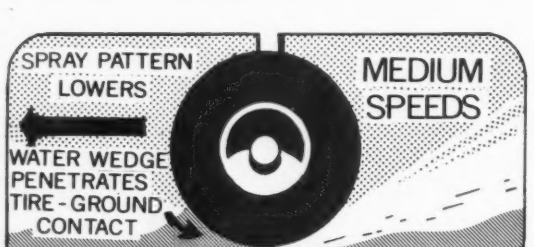


Figure 4. Partial hydroplaning

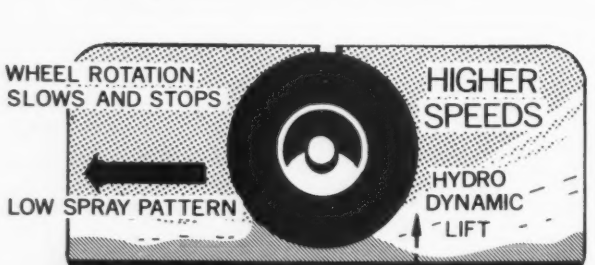


Figure 5. Total hydroplaning

Hydroplaning occurs at various speeds, depending upon the condition and pressure of the tires, depth of the water film, and the character of the pavement surface. Weight of the aircraft has little to do with it.

A minimum fluid depth is required. This may range from approximately 0.1 to 0.4 inch, depending upon the condition of the tires and road surface.

Smooth tread tires operating on smooth pavement require the least fluid depth to hydroplane. The tread grooves that normally parallel the tire (not those that run across the tire) drain off the water, so to speak, which piles up in front of the tire.

A rough or open-textured pavement surface requires a greater fluid depth than a smooth surface for hydroplaning to occur. Apparently the hills and valleys on an open-textured pavement surface provide paths for the trapped water to escape, thus delaying the buildup of pressure in the tire-ground region required to produce hydroplaning.

When this fluid depth is exceeded for any tire-pavement surface combination, the groundspeed required for hydroplaning is almost entirely dependent upon tire inflation pressure.

Low pressure tires allow more rubber to touch the pavement, so it would seem they would hydroplane at a higher speed. But NASA's study proved that this is not so. In one group of experiments a vehicle with tire pressure of 16 lbs per square inch began to hydroplane at 40 miles per hour. The same vehicle with tire pressure of 25 lbs per square inch started hydroplaning at 52 miles an hour.

As far as hydroplaning is concerned, large aircraft are safer than small ones. It is not because

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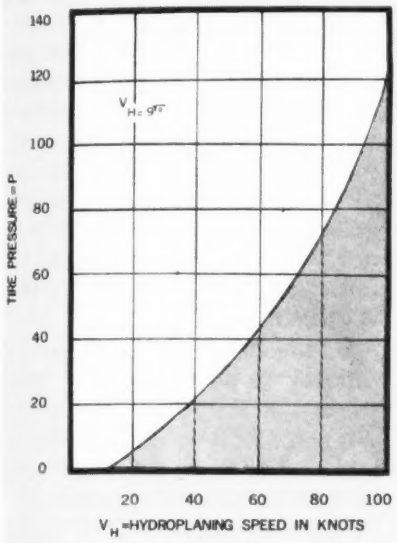
*Left: consider the case of an unbraked pneumatic tire rolling on a fluid covered runway as in an airplane takeoff. As the moving tire contacts and displaces the stationary runway fluid, the resulting change in momentum of the fluid creates hydrodynamic pressures that react on the runway and tire surfaces. In line with hydrodynamic theory, the resulting hydronynamic pressure force, acting on the tire as groundspeed increases, tends to build up. As groundspeed increases, fluid inertia effects tend to retard fluid escape in the tire-ground contact region, and the fluid wedge formed tends to detach the tire from the ground. At some high speed the hydrodynamic pressure is so great it forces the tire to lift completely off the runway surface. Figures 1-5.

POSSIBLE TIRE TOTAL HYDROPLANING SPEEDS FOR ARMY AIRCRAFT

(TIRE PRESSURES BASED ON REPRESENTATIVE TAKEOFF GROSS WEIGHT SERVICING)



TYPE AIRCRAFT	GROSS WEIGHT LBS	NOSE WHEEL PSI/KT	MAIN WHEEL PSI/KT	TAIL WHEEL PSI/KT
O-1A	2,100		30:49	35:53
O-1E	2,400		30:49	35:53
OV-1A	12,345	65:72.5	90:85	
OV-1B	13,310	65:72.5	90:85	
OV-1C	12,670	65:72.5	90:85	
U-6A	5,100		25:45	35:53
U-1A	8,000		28:48	36:54
U-8D	7,300	30-35 : 49-53	40-43 : 57-59	
U-8F	7,700	30-35 : 49-53	40-43 : 57-59	
CV-2B	28,500	38 : 55	35:53	

A fairly simple formula based on classical hydrodynamic lift theory accurately predicts total hydroplaning speeds. $V_H = 9\sqrt{p}$ where V_H = tire hydroplaning speed in knots and p = tire inflation pressure in pounds per square inch. The equation proves valid for smooth tires or for grooved tires where fluid depth exceeds tread groove depth.

they are heavier but because their tires have a greater pressure per square inch. At higher pressures they are able to travel at greater speeds before they hydroplane.

It is most important that all aviators and aviation personnel be aware of the existence of tire hydroplaning and understand how and when it may occur. With this knowledge, certain procedures may be followed to minimize the danger.

Tires of aircraft should be kept at highest allowable pressure, and every effort should be made to keep runways free of standing water.

In the operation of aircraft when landings and takeoffs are made on wet runways, techniques such as minimum "safe" touchdown speed, early runway contact, and early use of spoilers, wheel brakes, and reverse thrust should be employed to decrease the aircraft landing roll.

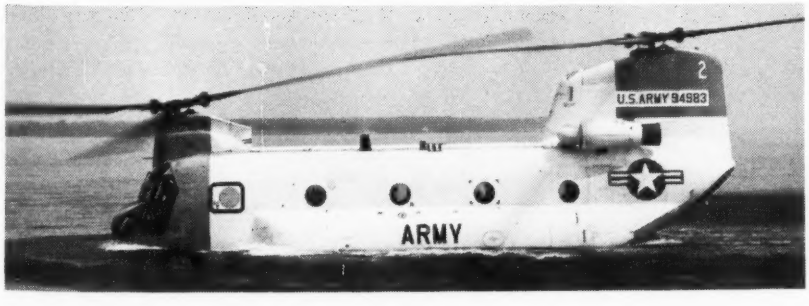
Apply reverse thrust and wheel brakes with caution, since asymmetrical thrust or drag on the aircraft for slippery runway conditions will be difficult to control.

Curtailment of operation in the presence of crosswinds, during takeoff, and landing on flooded runways should be considered.

REFERENCE

Horne, Walter B. and Dreher, Robert C.: Phenomena of Pneumatic Tire Hydroplaning. NASA TN D-2056, National Aeronautics and Space Administration, Washington, D. C., November 1963.

Expanding Army Aviation Flexibility



A CH-47A CHINOOK demonstrates its water landing capability in a series of tests to ensure that the aircraft meets all the Army's requirements for water landing, water taxiing, and flotation operations. The Chinook's flotation capability is made possible by a sealed-in production fuselage.

— BOEING PHOTO

A Few Drops Of Water, A Grain Of Sand, And...

THREE OR FOUR drops of water or a single grain of sand can cause the destruction of a million dollar aircraft and the death of all those on board.

For this reason, elaborate precautions are taken by the Army and its suppliers to see that fuel reaches aircraft tanks in the purest possible form. Tests are made all along the line to determine the purity of the fuel, and when contamination is found, it is eliminated or the fuel is discarded.

In the long journey from the refinery to the aircraft, final storage at the forward area and the actual filling of the aircraft tanks seem to be the most critical points for contamination.

Realizing this, the U. S. Army Mobility Command Engineer Research and Development Laboratories (USAERDL) at Fort Belvoir, Va., has developed a final filter/separator to be used

Paper, salt tablets, cellophane, and flashlights have been found in fuel tanks of Army aircraft

when fueling an aircraft in the field.

This filter/separator is a 15 gallon - per - minute unit to be used with hand-operated pumps and will meet filtration requirements for fueling light liaison planes and helicopters from 55-gallon fuel drums.

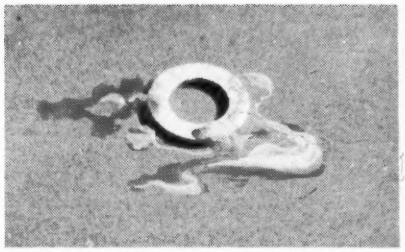
In mid-1962, 33 of these units were shipped to the Republic of Vietnam to support fueling of Army aircraft. A report received in March 1963 said that these filter/separators were very efficient and required little upkeep. Their use may greatly reduce accidents from fuel contamination, but the danger still exists.

Numerous items are found in tanks that could not have been pumped in with the fuel. For instance, just recently a flashlight was found in the tank of a helicopter. As the fuel reacted on the plastic case, batteries, and rubber seals, they had begun to disintegrate and tiny particles were finding their way into the system.

Other items found in fuel tanks are paper, cellophane, O-rings, and even salt tablets. Like the flashlight, these are exceptions, but they show that foreign items can and do get into the fuel tank.

The filter will separate most of the rust, dirt, water, and other foreign matter that has entered the fuel up to that point. But after it leaves the final filter, the fuel still must travel through the hose, nozzle, and neck of the tank. In this short space, contamination of the worst sort may occur.

The hose nozzle used in the refueling operation can contaminate. If the nozzle is roughly jammed into the filler neck, brass and aluminum are skinned off and dropped into the tank. Only a few small pieces come



O ring found in fuel cell

off each time this rough handling occurs, but if this action is repeated day after day quite an accumulation builds up.

Once these minute particles are introduced into the fuel tank, they can be carried along until they jam or plug a screen. Or they may reach the combustion chamber of the engine with possible serious results.

The nozzle is also a prime culprit in the introduction of small particles of earth and nonmetallic materials. Like metal, dirt may lodge in a valve or be carried into the combustion chamber.

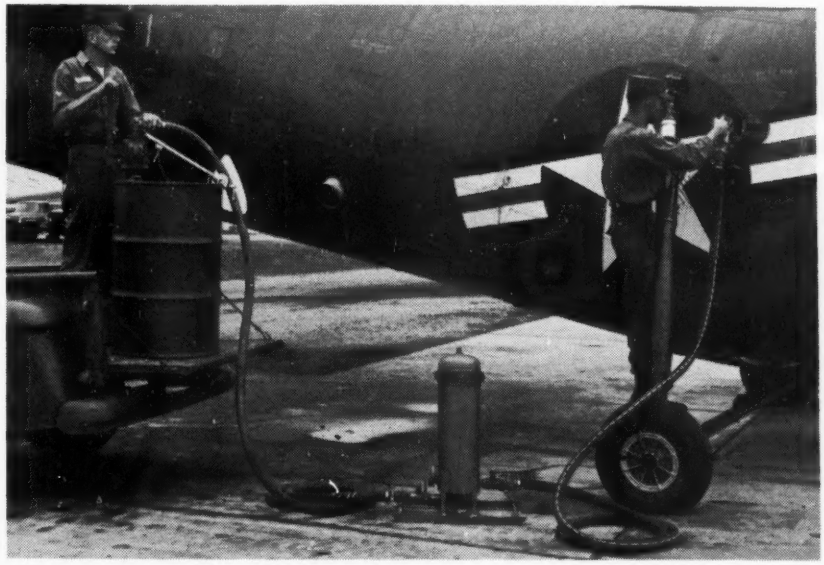
If enough dirt adheres to the fuel nozzle, inner liner, turbine nozzle, or wheels, it forms what is known as a "hot patch." This hot patch hits the metal, and serious damage can result.

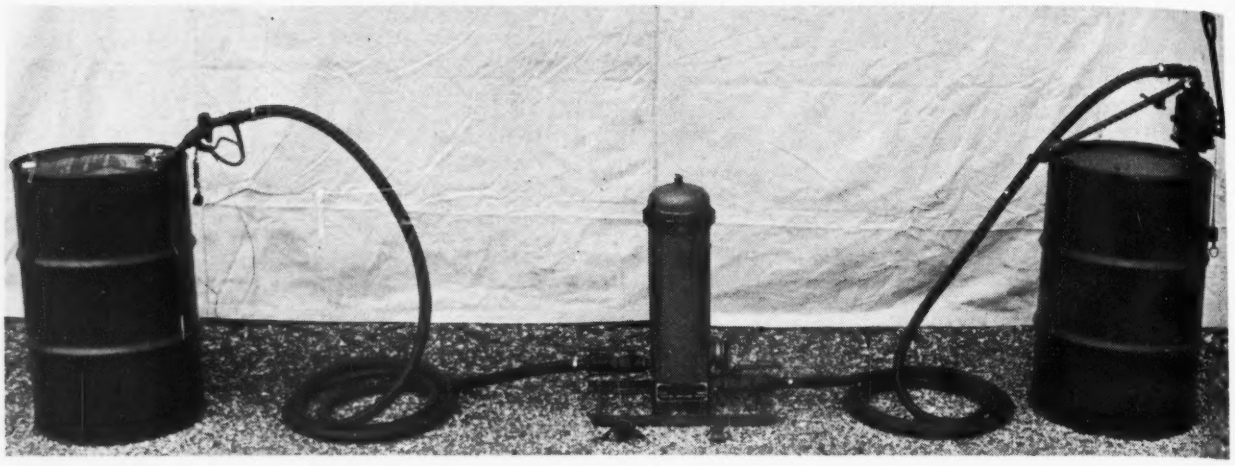
The elements may introduce foreign matter while the cap is off the tank. Wind will blow in all kinds of dirt. Even when it's not windy, dust and rain may enter.

Water is a sneaky form of contamination. One or two drops in JP-4 won't cause difficulties under normal conditions. But in large amounts or when the temperature is freezing, water becomes a killer. In low temperatures ice forms, which clogs filters, nozzles, and fittings, or sticks and clogs valves. This in turn restricts fuel flow and can cause engine flameout.

Water is not always in the same form. It can be free, suspended, or entrained. Free water can be seen as blobs on top or bottom of the fuel. The size of the blobs depends upon the amount of water. Suspended water forms very small bubbles that give the fuel a milky look. Entrained water is the hardest type to see. Similar to the humidity in the atmosphere, it is

Fifteen gpm filter/separator proved efficient under field conditions in the Republic of Vietnam





Filter/separator can be used to filter fuel from drum to drum or from drum to aircraft

held in solution in a percentage which varies with temperature and pressure.

Free water can be separated most easily by the filter. A lot of the suspended water will be separated, and most of the rest will settle out if the fuel is allowed to remain undisturbed for a period of time. It then becomes free water and can be filtered or drained off.

The hardest type to eliminate is entrained water. The best way of getting rid of this type is by "cold soaking." In this method, the fuel is refrigerated. This causes the water to be precipitated like rain, thus becoming free water. Obviously it's not easy to do this after the fuel is in the aircraft tank. But that is exactly what the fuel tries to do when the aircraft is suddenly taken up into the cold air. The fuel rids itself of water, which forms ice — and trouble.

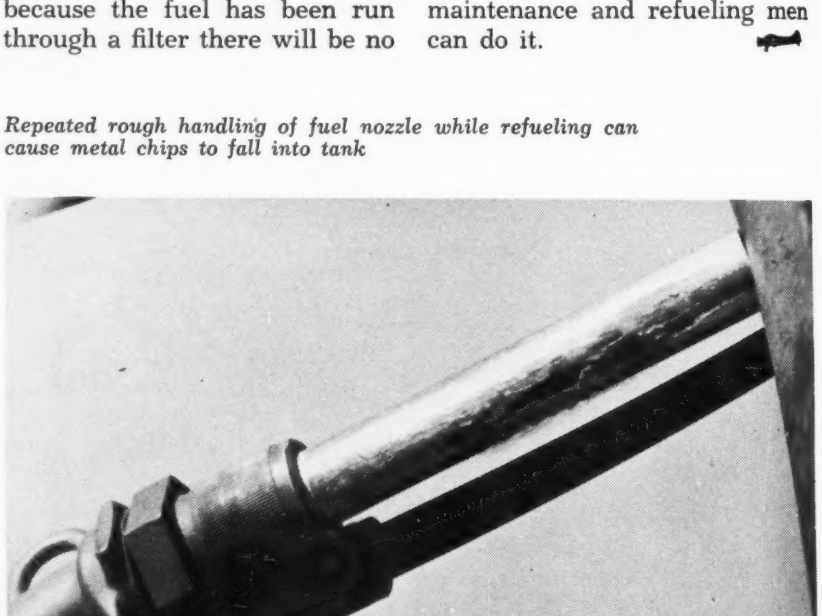
Water enters the tank in many ways. If the fuel is relatively free of water when it's brought to the aircraft, the filter/separator will clean up most of the impurities. But again the fuel must pass through hoses, nozzles, and filler necks. And again it may pick up more water.

For instance, if the temperature of the nozzle is different from the air around it, condensation will form droplets which can be pushed into the tank by the flowing fuel. Or the cap of the tank may be opened in the rain, allowing water to get in.

The danger is in assuming that because the fuel has been run through a filter there will be no water. Fuel drains must still be emptied at the prescribed times, or oftener during damp or rainy weather.

Filter or no filter, those few drops of water or grains of sand must be prevented from entering the tank. And only the maintenance and refueling men can do it.

Repeated rough handling of fuel nozzle while refueling can cause metal chips to fall into tank



CV-2 Fluid Line Corrosion

RECENTLY, several defective fluid carrying lines (oil, fuel, hydraulic) have been found forward of the firewalls and in the wheel wells of CV-2 aircraft. Fittings on these lines were found corroded to the failure point by a type of corrosion known as "dissimilar metals corrosion." This is caused by the contact of two different kinds of metal in the presence of an electrolyte, which is a solution capable of conducting an electrical current. It has been found that every metal has a certain inherent electrical potential; and when one metal is placed in contact with a metal of a different potential in the presence of moisture and an electrolyte, an electrical current flows from one to the other, giving rise to chemical by-products, but principally resulting in the dissolution of one of the metals. The metal from which the current flows is called the anode, and that to which the current flows is the cathode. Qualitatively, the severity of corrosion, caused by a dissimilar metal contact in the presence of a corroding medium, can be predicted from the potential difference of the metals making up the cell. The greater this difference, the more severe the corrosion, the negative metal being corroded.

USABAAR recommends immediate one-time and periodic inspections of CV-2 fluid carrying lines and fittings for the type of corrosion described above.

—USABAAR

Do You Know?

TOMORROW MORNING you are assigned a routine administrative flight in the U-6A Beaver, that trusty old bird. If you can close the doors, it will fly — or will it? Well we know that we have a 365F on file, and therefore have nothing to worry about in that respect.

Just for fun though, try your hand at some routine questions about that "trusty old bird" to refresh your memory. These questions pertain to the U-6A:

1. At gross weight, what is your best glide airspeed to obtain maximum gliding distance?
2. What is your best airspeed for flight through turbulent weather?
3. What is the recommended airspeed for bailout?
4. What is the maximum allowable airspeed for lowering flaps?
5. If you are carrying wing loads, what are the three ways for jettisoning them?
6. What would be the *initial* effect on rpm and manifold pressure if carburetor icing were present?
7. What action would you take if you encountered an overspeed condition of the propeller (sudden increase in rpm)?
8. What action would you take if you encountered an underspeed condition of the propeller (sudden decrease in rpm)?

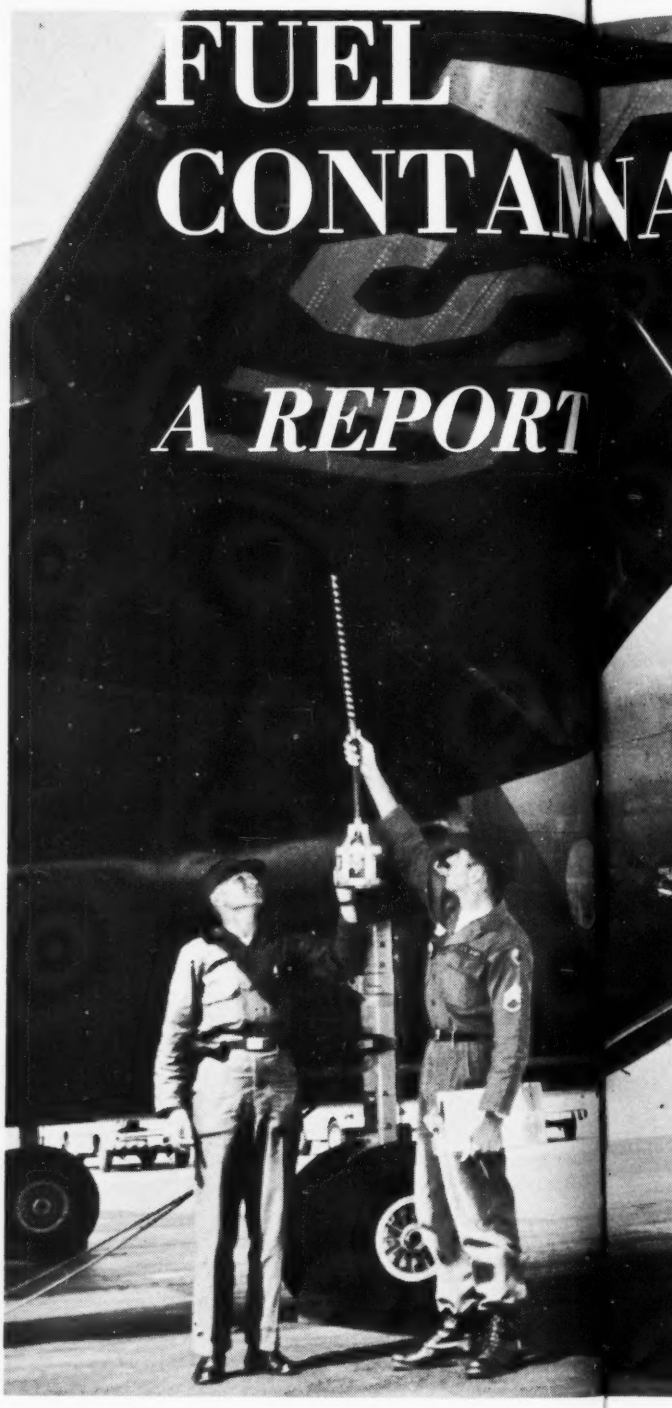
Following is a list of answers to the questions above. Included are pertinent references to TM 55-1510-203-10.

1. 85 knots. (Chapter 4, Section IV, page 4-1)
2. 100 knots. (Chapter 10, Section IV, page 4-1)
3. 65 knots. (Chapter 4, Section V, page 5-1)
4. 91 knots. (Chapter 7, Section III, page 3-1)
5. Normal, emergency salvo, manual release (one in each wing root). (Chapter 6, Section IV, pages 4-1 and 4-2)
6. No change in rpm, decrease in manifold pressure. (Chapter 9, Section II, page 2-2)
7. Throttle closed, airspeed reduced to 55 knots (64 mph), propeller lever — high pitch. (Chapter 4, Section II, page 2-2)
8. Propeller lever, high pitch; throttle, not to exceed 29" Hg; airspeed, highest possible; check oil pressure continuously. (Chapter 4, Section II, page 2-2)

This quiz was prepared by Capts John E. Hally, Jr., and Endel Raidmets, Dept of Maintenance, Ft Rucker, Ala.

FUEL CONTAMINA

A REPORT



A few years ago, in the wake of concern reaching alarming proportions, a study of fuel tank corrosion and fuel contamination was instituted. As new information became available, reports were issued by various agencies to keep aviation personnel informed. The following article covers most of what is known on the subject at this time. Of course, it is not a final report as the study of the problem is still in progress.

HUNDREDS OF different forms or types of microorganisms thrive in fuel tanks. (Researchers generally limit the number of "harmful" microorganisms to about 100, but the greater tendency is to suspect all minute life forms present in fuel.) This is true of aviation gasoline to a degree, but microorganisms are much more prevalent in kerosene type fuels.

When first considered a source of real trouble, this broad category of fuel contamination was generally referred to as *green slime*. Later reports revealed frequent discovery of contamination or slime in various colors, particularly brown and white. In truth, the many combinations of harmful microorganisms can produce slimes with a variety of physical characteristics, including colors.

Fuel contaminants can generally be subdivided into four types — particles, surfactants, water, and microorganisms.

• Particle contamination usually consists of rust or sand.

• Surfactants (surface active agents) are chemical compounds, which usually are partially soluble in water or fuel. Similar to ordinary household detergents, they are usually introduced to fuel as a by-product of fuel processing or of fuel additives. They have a tendency to reduce the surface tension in fluids and to collect on water droplets, solid particles, and airplane components (including filters and plumbing wall, as well as primary structure).

In addition to the potential trouble that surfactants alone can cause in fuel tanks, these compounds also carry water and other contam-

This report was adapted from an article published in Issue No. 42 of the Lockheed Service News (September-October, 1963), copyrighted by the Lockheed-Georgia Company Division of Lockheed Aircraft Corporation.

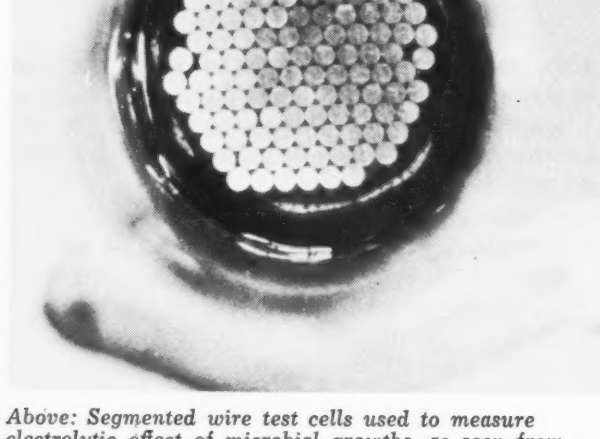
inants through filter-water separators. Another troublesome aspect of surfactants is that they will remain in solution with clean dry fuel. Then when water and other contaminants are introduced, the surfactants will "wash" out, forming a sludge which settles toward the bottom of the tank.

• Water exists in three states: free water, which tends to settle out of fuel; suspended water, which forms very small bubbles that give fuel a milky look; and entrained water, which is very hard to see. Entrained water is similar to the humidity in the atmosphere and is held in solution in a percentage which varies with temperature and pressure.

Water can be separated from the fuel in many ways. The most common method of separation is filtering. A lot of the free water will separate this way, and the rest will settle out if the fuel is allowed to remain still for a time. Entrained water can be separated by "cold soaking." In this method the fuel is refrigerated until the entrained water becomes free water.

Water and JP-4 are harder to separate than are water and aviation gasoline. This is because their densities (specific gravity) are so close to each other.

• Microorganism contamination in fuel may exist in three broad categories: fungi, bacteria, and algae. Algae have been pretty well ruled out as a source of real trouble. Most researchers agree that the widespread microorganism contamination in jet fuels is confined to fungi and bacteria.



Above: Segmented wire test cells used to measure electrolytic effect of microbial growths, as seen from the bottom. Below: A side view of the same container showing growths at the interface of water and fuel.

Microorganism contamination apparently can flourish only in the presence of all of the other types of contaminants found in fuel, and the temperature must be between 32° F and 130° F.

In at least one (and possibly many) sample of contamination it has been shown that one particular microbe thrives in kerosene type fuel. This microbe gives off a sugary substance which is consumed by still other microorganisms. These, in turn, produce alcohol, consumed by still other microbes. And these give off acetic acid, which induces corrosion in aluminum.

GROWTH INHIBITORS

Among the many possible preventives for microorganism corrosion is something to kill the microbes or at least to inhibit or prevent their growth. This particular preventive measure suffers from the fact that microorganisms have phenomenal ability to develop an immunity to any sort of biocide. In fact new types of bugs will often develop with a real taste for something originally developed as a poison.

Still, among the promising deterrents to a further spread of microbial contamination is a biocidal fuel additive. One particular additive, PFA 55MB, was developed as an anti-icing additive. Since the discovery that fuel containing this additive exhibited no tendency to support microorganism contamination, further study of the additive is underway.

Although this additive is relatively new, it has come into wide use. It is qualified to Specification MIL-1-27686A and is being specified for use in JP-4 in an 0.10 or 0.15 percent concentration by volume. When first introduced, the additive included a substantial amount of glycerine. Some objection was raised to this, as the glycerine tended to settle out on capacitance type fuel quantity probes. Subsequently the quantity of glycerine has been reduced to eliminate this problem.

FILTERS

Too much reliance on filters has perhaps been one of the major contributing causes in the present fuel contamination problem. This is no particular fault of the filtration systems. It has risen more from the tendency toward poor housekeeping, based upon the assumption that the filter water separators would return contaminated fuel to a clean, dry state.

The most serious reported cases of contamination have been traced directly to faulty filtration. In some instances filters have clogged and fuel has continued to be delivered through a bypass.

In other instances, the filter element has failed.

Rupture of a filter element is preceded by a rapid pressure buildup. Unless someone is observing the gauges at the precise moment of failure, the pressure may drop back to normal and the failed element may remain undetected until the next periodic replacement. Not only does a failed element permit the delivery of unfiltered fuel, but at the moment of failure, the filter turns loose a big slug of contamination to go downstream and mix with previously cleaned fuel.

It must be remembered that filters wear out and should be changed every year with coated tanks and with uncoated tanks every three months.

HARMFUL EFFECTS OF CONTAMINATION

Initially, by far the greatest concern with microbial contamination is with the pronounced corrosive effects upon the metal structure of integral wing tanks. This has proved to be a most aggravating and expensive problem, in that it has made necessary much work in cleaning and repairing tanks and scaling systems.

Soon after the contamination problem became widespread, however, there became apparent another and perhaps greater threat than corrosion. Since the microbes develop and multiply so rapidly, they have been found capable of rapidly growing to such proportions that they plug capacitance type probes in the fuel quantity indication system, and in some instances they can clog in-line fuel filters and fuel nozzles.

Thus a stringent surveillance program is essential. "How much is too much contamination?" is a very difficult question to answer. The sampling technique is also critical and requires more than ordinary concern.

FUEL SAMPLING AND TESTING

Fuel samples should be taken with a sterile condensate drain tube — not just a clean one — and the drain tube assembly returned to the POL quality control officer for resterilization after each use.

Use of the drain tube is conventional, except for one important suggestion. Experience has shown that once a drain tube has been inserted into the drain valve, a steady flow of fluid will cause vortexing. Once this vortex, or swirl, is established, fuel will be drawn from intermediate levels in the tank more than from the bottom. And, of course, water and contamination concentrate in the bottom of the tank.

To prevent this vortexing, pogo the tank with short steady jabs of the condensate drain tube. This way the fuel and water will be unable to establish a steady flow and the drawoff will come primarily from the bottom of the tank.

Since the presence of microbiological contamination requires immediate countermeasures, fuel samples should be handled on a high priority. The POL quality control examination of the fuel samples should follow as soon as possible after they are taken.

Only a trained technician can perform the required tests for the presence of microbial contamination in fuel. In truth, of course, the relatively great quantities of microbial contamination found from time to time will produce a sample in which the slime is readily visible to the naked eye. But due to the rapid growth possible, even a trace of microbial contamination invisible to the naked eye might be critical and suggest corrective action to a trained technician.

IMPROVEMENT PROGRAM

The following is a five-point program which, if introduced generally, would relieve the fuel contamination problem quite adequately:

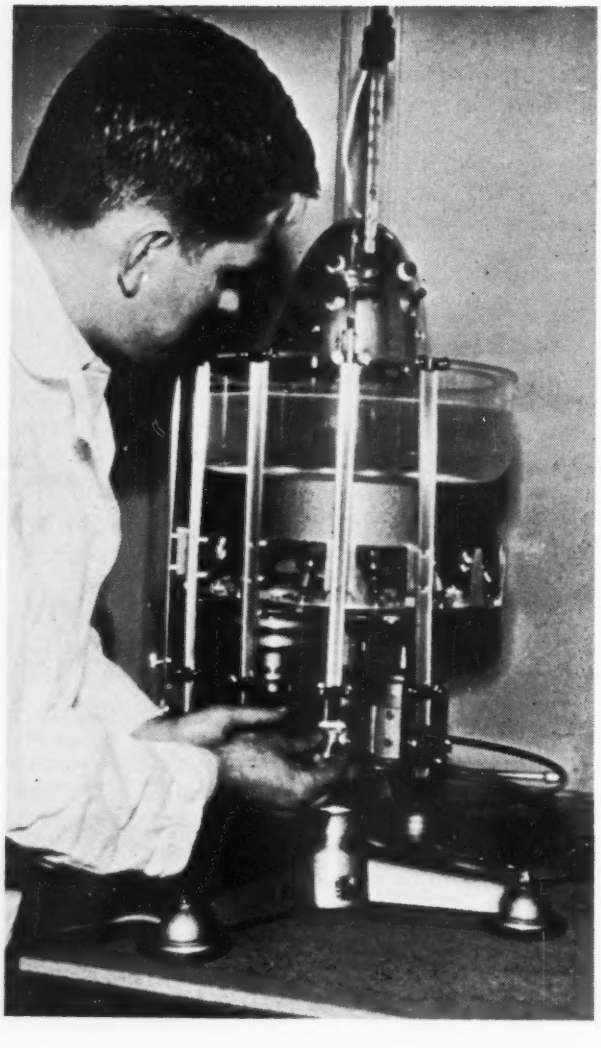
- Use a biocidal additive (such as 55MB) in all jet fuels.
- Remove water from bottom of fuel storage tanks at all facilities under control of the United States military agencies.
- Use a portable water removal filter during refueling in the field. This should be the non-bypass type and as much an absolute water separator as can be obtained.
- In those tanks that use it, apply a new coat of approved anticorrosion material to all new or reworked and resealed tanks.
- Inspect the fuel on a regularly scheduled calendar basis to discover contamination before it progresses to serious proportions.

CLEANING FUEL TANKS AND PROBES

When an aircraft fuel system indicates a suspicion of contamination, someone usually raises the question: Is the contamination serious enough to open the fuel tanks and clean them?

The question really is academic. Weighed against the safety of an airplane and its crew, the quantity of contamination or the size of the "bugs" is immaterial. Foreign matter in a fuel system is a potential hazard and the safest route to follow is — clean it out.

Samples from contaminated tanks may reveal rust, dirt, metal shavings, green slime, stringy matter, or dirty bubbles at the fuel/water interface. Again, the water bottom specimens may be fairly clear. Only a laboratory analysis will positively confirm the presence of the microbial type



Trained technicians are necessary to perform required tests for determining presence of microbial contamination in fuel

of contamination. And only inspection of the tank interiors will tell how far contamination has gone and whether corrosion exists.

The purging and cleaning process is the same for any contamination, except that you go a step further to get rid of microbial bugs that thrive in jet fuel condensate.

An example of how persistent fuel contamination can be: Recently the fuel tanks and probes of an aircraft were thoroughly cleaned before a cross-country flight. After landing, a postflight check revealed a brand new crop of sludge clogging things up.

This demonstrates that when dirty fuel goes into clean tanks, you can expect trouble eventually.

In many cases contamination will cause erratic or erroneous fuel gauge readings. But this is not an ironclad indication because the probes may be shorted due to silver migration. (A new type of coating now being applied to fuel probes is expected to end silver migration.)

Microbial contamination doesn't always show up in the airplane's fuel filters, either. Sometime ago the tanks of several aircraft were opened after repeated erratic fuel quantity gauge indications. Sure enough, contamination was there, concentrated in the surge areas. But the filters showed no trace of bugs.

Each different aircraft has definite prescribed procedures for cleaning fuel tanks and probes. In general, though, the following procedure is recommended by the various manufacturers.

Before removing probes, drain and mop fuel from each tank. Ventilate all tanks thoroughly with warm air.

Remove the probes and compensators and check each with a tester for proper capacitance values. If there is no drop in capacitance, the unit doesn't need cleaning.

The two most common causes of fuel probe failure are contamination and silver migration. Both show up on the tester as a low capacitance reading.

If low capacitance is due to surface contamination it will usually come up to normal when the probe is allowed to dry off, but will read low again when moisture is applied.

On the other hand, silver migration will cause a low reading whether the probe is wet or dry. Therefore, if the probe is checked for leakage under dry conditions and reads low, silver migration is most likely the cause. In such cases, reject the faulty probe and replace it with a new one.

To clean fuel probes, fill a large clean container with warm water and ordinary household detergent. Lay the probes carefully in the solution and let them soak for a few minutes. Agitate the solution around the probes for two minutes using an air gun and about 75 psi pressure. Remove the probes and swish them free of detergent in clear water. Finally, let them dry in a warm room for 24 hours or in an oven at 100° F to 120° F for an hour or so.

Recheck the capacitance of the cleaned probes and if they still don't come up to standard, replace them with new parts.

Scrub the interior of the tanks with hot (120° F to 140° F) emulsion cleaner manufactured to specification MIL-C25769B, diluted 30 to 1 with

water, using a soft brush. After the interior has been cleaned, including the vent box and access door, flush the cells with moderately high pressure water. Remove all water possible by draining, then get rid of all puddles by vacuuming and mopping.

If the tanks are the bladder cell type, extreme care must be used to prevent puncturing or tearing the relatively soft walls.

If tests have shown that microbial contamination is present, spray the interior surfaces with a 50-50 solution of water and methyl alcohol. This solution must remain in the tank for at least five minutes to kill the "bugs." Vacuum and mop to clean out any remaining pockets or puddles.

If there has been an indication of bugs the tanks should be closely examined for corrosion. Use high efficiency spotlights and mirrors to ensure that each and every part of the tank is inspected. Give particular attention to areas under rib caps and H clips and other blind spots.

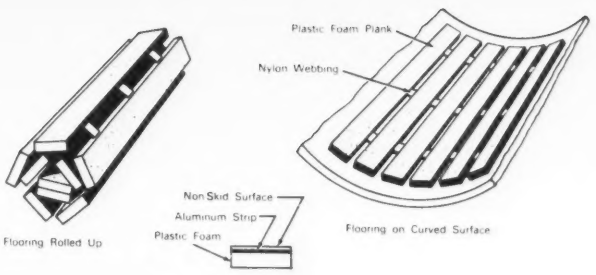
Likely indications of corrosion are dark spots, pinholes, blisters in sealant and coatings, and areas where coatings do not adhere to the skins.

Fuel in coated tanks must be replenished within definite time limits to avoid degradation of the corrosion-resistant tank coatings, which results from the absence of fuel. Uncoated tanks can remain dry indefinitely.

Integral tanks should not normally stay dry more than 14 days and bladder tanks not more than 10 hours. When it is necessary for these time limits to be extended, the inside of the tanks should be wiped with grade 1010 engine oil. Then they can go without fuel for an unlimited time. When refueling is done, this lightweight oil is left in the tanks.

Here are some general precautions when cleaning fuel tanks.

- Cover tank bottoms with heavy noncombustible paper, cloths, or other materials to protect them from damage from dirt, tools, foreign materials, or yourself. Remove shoes to prevent banging up sealant and interior surfaces.
- Never use stiff-bristled brushes to scrub any tank.
- Observe rigidly all safety precautions against fire and fume inhalation when entering a tank. Be sure ventilation is adequate.
- Methyl ethyl ketone (MEK) used in cleaning is both flammable and toxic. Keep it away from your eyes and avoid breathing fumes.
- At all times, when working inside a tank, have someone standing by outside in case of emergency.



Tread Softly

ARE YOUR big shoes scratching the paint on the wing of that U-8D? Are you having trouble protecting the inside of storage fuel tanks when you clean them? If so, temporary plastic foam flooring may solve your troubles.

This temporary flooring is not an item of issue yet — simply because it is not being manufactured. But you can make it out of material normally found in your shop.

Fasten foam strips (styrofoam, polyurethane, or similar plastic foam) about 1 inch thick and 4 inches wide together with nylon webbing 2 inches wide. Length of the foam planks may vary to fit your own situation. The nylon webbing can be attached to the foam in any number of ways but one of the best is to run the webbing through slots cut in the planks. Aluminum strips approximately 0.020 inch or thicker are glued to the tops of the planks and then an adhesive-backed, nonskid surface is cemented over the aluminum.

The resulting mat is a lightweight, portable, temporary flooring that will support the weight of a mechanic. It can be quickly rolled up and carried through the openings of cylindrical or spherical tanks where large timbers or braces on stringers can't be used.

Not only will the portable flooring serve as a satisfactory support for the mechanic and his equipment but it will also act as a shock absorber if tools are dropped. It is lighter and offers more protection than wooden floor mats and distributes weight better than plain foam rubber pads.

It can be used as temporary flooring over flat, curved or irregular surfaces which must be protected. The portable foam flooring is particularly useful where only a small opening is available or where weight of the protective flooring would be a work factor.

It can also serve you as a temporary passenger walkway to an aircraft over wet ground, or as a protective covering for walking on wing surfaces in ground handling. *—NASA Tech Brief*

omega

Lieutenant Colonel Morris G. Rawlings (Ret)

SO YOU WANT to be an Army Aviator? Any particular reason? Exciting career? Flight pay? Ambition beginning to gnaw at your vitals? Rather ride to work than walk? Think that Army Aviation needs men of your ability to conduct its business? Old-fashioned enough to believe that every man should do his best at a job of his choice to justify his existence?

Welcome.

Whatever your reasons, they are unimportant for they will change as you do. The important reasons are those which will motivate you after your graduation.

On graduation day at Fort Rucker you will climb the steps to the stage reminding yourself to take the paper in your left hand, salute and shake with your right, smile deprecatingly when congratulated, and above all, show no signs of nervousness. Actually, you will stumble on your first step; your face will be flushed from pride, embarrassment and exertion; your eyes will dart over the assembled audience to see that she is watching; your hands will be sweating and filled with the nervous jerks; and you would not recognize Santa Claus if he sat on your lap! So what! It is your day.

The guest speaker, whom you will recognize by name or reputation, will follow with his day. He will stride to the podium, shuffle his notes, pretend to lay them aside, and deliver himself of an "extemporaneous," carefully-prepared list of cliches intended to set a mood and to

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Lt Col Rawlings, Ret, is with Combat Operations Research Group, USACDC, Ft Belvoir, Virginia.

release you quickly for the pursuit of pleasure.

When the excitement is over and the partying is done — when the business of reporting to your first aviation assignment is no longer words on a DA order, but is instead stark reality — you'll wonder if you are really ready. You'll search your memory for those words of assurance which you received during your course of instruction and at your graduation ceremony.

There's only one difficulty: you didn't hear any!

All sorts of people congratulated you on having completed a difficult and demanding course of instruction, deliberately designed to weed out the unfit and unwilling. They told you that your services were needed, that there was much work to be done, and that they wished you success. Nowhere and at no time did anyone tell you that you had it made — that your training and experience would make the assignments simple. Your mentors wished neither to lie nor to discourage you by emphasizing the obstacles ahead.

What the guest speaker said at graduation was what he felt you wanted to hear, not necessarily what he felt you needed to hear. Had he been willing to talk, and had you been willing to listen, this is what you might have heard:

Gentlemen, as typical Americans you are expected to shrug off congratulations with a shy smile and an "Aw, it wasn't so much" attitude. You will do so publicly. Privately, however, you will assess your own accomplishments and be proud. Do so. You have every right.

Guest speakers are chosen not so much on the basis of knowledge but because of their reputation, their rank, or their experience. I speak from the latter. Unfortunately, experience cannot be transmitted from person to person as can knowledge. You will gain experience exactly as I did — by learning which actions produce what results under what circumstances.

Meanwhile, the real difficulty you face is in preparing yourself to gain experience. That you were prepared to come to the Aviation School is self-evident — you graduated. That you are now ready to function for the Army in an acceptable, satisfactory manner is a matter yet to be decided. I think I know four things which will help to ensure your success.

Point number one: *Do not allow yourself to become discouraged.* You know what Army Aviation can do for the ground forces and how it can augment their capabilities. You will be associated with many who do not know and those who, frankly, do not care. Those who do

Continued on page 48

PERSONAL EQUIPMENT

Captain Frank Ogden
Flight Surgeon

FLIGHT GEAR, the personal equipment used by aircrew personnel, is a problem with all the services, particularly the Army. We have taken leftovers or done without in many instances. The equipment we have is often poorly used.

Let's take a look at what we have, starting from the head and working our way down:

HELMETS — Lieutenant Seifridge was the first Army Aviator to die in an aircraft crash. Like the pilots of World War I and World War II, he wore a leather helmet which was designed for wind protection only, with no thought for crash protection. Had he been wearing the type helmet our aviators wear today, he might have survived, *if the helmet had stayed on during the crash sequence.*

The APH-5 can withstand over 200 g's, a rather severe rap on the head, but far too many helmets are flying off during aircraft accidents. Our problem has become one of helmet retention rather than crash force attenuation. Helmets come off because of . . .

Improperly fitted nape straps, one of the leading causes of helmet loss. If the nape strap is loose, the helmet can be peeled right off the head.

Unfastened or improperly adjusted chin straps. Recently, the WEEKLY SUMMARY (a report compiled by USABAAR) published a photo of a helmet lost from a pilot's head because of a broken snap. Sometime before the accident, he'd said, "I'll get it fixed later." Fortunately, he escaped with a minor head injury. Others weren't so lucky. Another pilot had replaced his chin strap with one from a football helmet, a very unsatisfactory substitution.

An improperly fitted helmet can have lethal results even though retained. A CH-34 pilot died as a result of the rotor brake handle penetrating his forehead. TM 10-8415-202-15 calls for the helmet to be adjusted *low on the forehead,* but not so low as to cause limitation of upward vision.

Helmet earphones present an unsolved problem. They are very uncomfortable and some cause pressure above the ears which results in temporary damage to a small nerve.

FLIGHT SUITS — The gray KB-2 flight suit acquired from the U.S. Air Force has been the standard item of issue for several years. Recently, the international orange flight suit was procured from Navy channels for issue to the Army. But in many areas, the use of either of these flight suits is prohibited by local commanders. Thus, fatigues are often worn in the cockpit. Until the Army gets a green flight suit that looks more like a uniform, this will continue to be a problem. As yet, a suitable green, fire-retardant material has not been found.

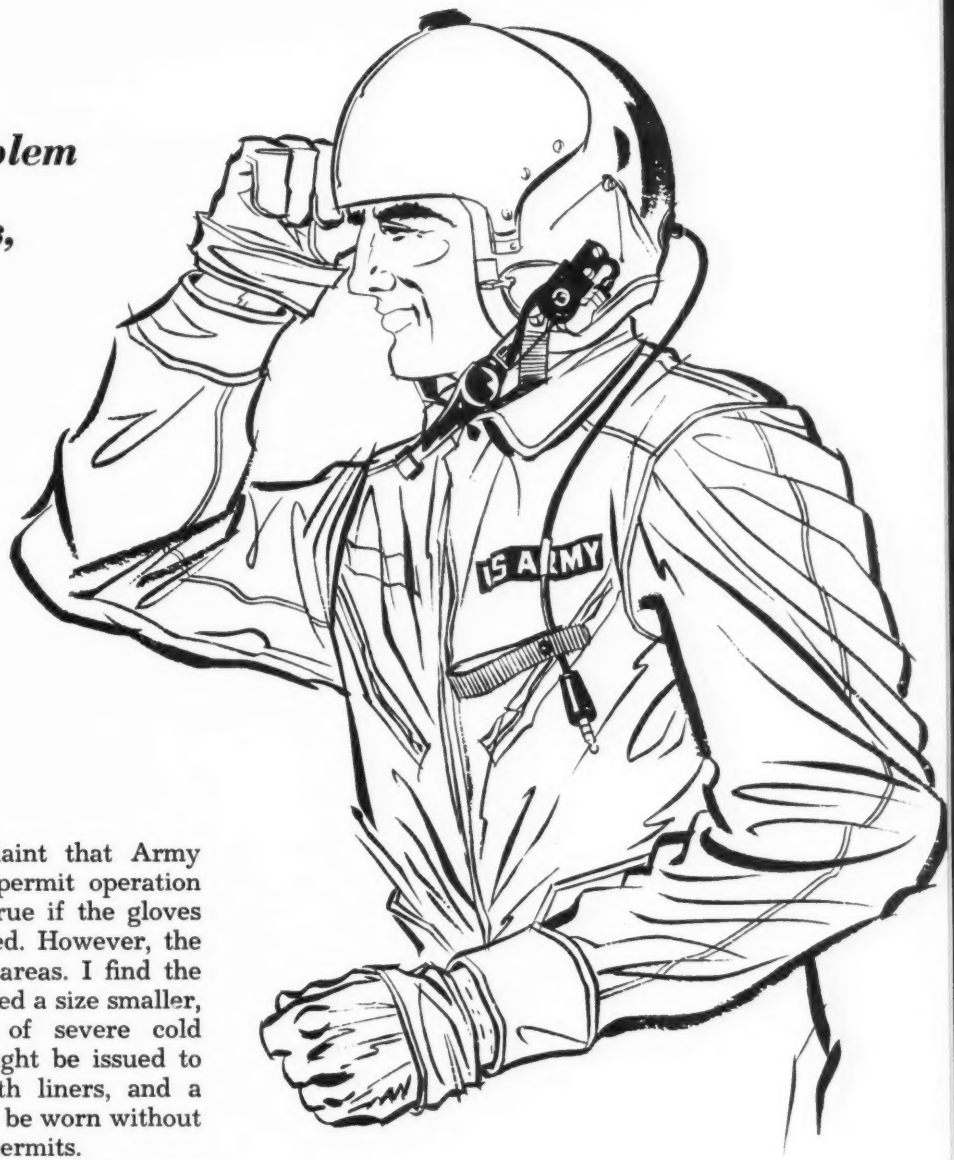
The orange flight suit is fire-retardant when issued new and remains fire-retardant until it is laundered approximately 14 times. It and the gray KB-2 flight suit can be treated by the following process:

1. Clean flight suits by washing them mechanically dry (use detergent).
2. Submerge and agitate 10 minutes at 100° F in the following solution:
   - 6 gallons of water
   - 2 pounds of borax (FSN GA 6810-264-9052)
   - 1½ pounds of boric acid (FSN GM 6750-174-5454)
   - 1½ pounds of ammonium phosphate, dibasic (FSN 6810-264-6547)
3. Hang to dry or iron with warm iron (250° F).

Fire retardant qualities are lost with each washing and must be repeated.

GLOVES — When I was associated with the Navy, I never flew with an aviator who did not wear gloves. Almost the reverse has been my experience with Army Aviators.

flight gear is a problem with all the services, particularly the Army



I frequently hear the complaint that Army issue gloves are too sloppy to permit operation of small switches, etc. This is true if the gloves are fitted with the liners inserted. However, the liners are not needed in many areas. I find the gloves satisfactory if they are fitted a size smaller, without the liners. In areas of severe cold weather, two pairs of gloves might be issued to each pilot; one to be used with liners, and a second pair (one size smaller) to be worn without liners when the temperature permits.

Gloves in your locker or pocket are of no use in fires. A number of Army Aviators have survived crashes and ensuing fires, *and could have been returned to flight status except for the condition of their hands.* Burned fingers shrivel up and become distorted to the extent that some cockpit maneuvers are nearly impossible. Leather gloves would have prevented much of this damage.

UNDERWEAR — I mention this only to give a warning: avoid nylon underwear! Most aviators wear "Long Johns" in cold weather and rightly so. But some have been known to purchase nylon underwear. Nylon is dangerous because it melts in fire and forms droplets that adhere to the skin and cause very serious burns. Cotton underwear is recommended.

FOOTGEAR — Boots should be worn on all flights, particularly in OV-1 aircraft. In the event of bailout or ejection, those wearing low quarter shoes are likely to find themselves coming down barefooted. A survival situation in low quarters would not be good. Barefooted, it would be much worse.

Most aviators preflight their aircraft and practice inflight emergency procedures. How many preflight their personal equipment and practice emergency survival? I sincerely hope YOU do.

Informed by a World War II censor that he had ended a sentence with a preposition, Prime Minister Winston Churchill returned the note to the young man with the following sentence scribbled on the bottom: "This is the sort of nonsense up with which I will not put." Faced with a similar criticism, a school teacher replied: "A preposition is a bad thing to end a sentence with."

Churchill and the teacher were illustrating how silly hard-and-fast rules of writing can be. Thanks to Instructor Dan Lewis, this is the sort of nonsense up with which students of the Communications Skills class of the Army Aviation Safety Course do not have to put. And he doesn't care what they end their sentences with. All Instructor Lewis asks is that his students write, in their own words, a personal experience of the type all aviators have. That's why we're happy to welcome the students of Class 32 to the pages of CRASH SENSE in another edition of . . .

tales from the trojan

It Might Snow

IT WAS WINTER in Korea. Sunday morning dawned with the sun filtering through a gray winter sky. Through the few clouds hugging the cold mountaintops I could see a high thin overcast. Everything was peaceful and quiet.

I was stationed with a small force in a valley near the center of the country. Although an Army pilot, my ground duty assignment enabled me to fly only on weekends.

My roommate, Lieutenant Smith, had asked me the day before to fly him to Seoul. I told him I was going to fly anyway, so I'd be glad to take him.

We had breakfast in the dining room and walked across the deserted compound to the flight line. Only two people were on duty: the weather observer and an operations NCO. While I checked the O-1A, Lieutenant Smith sat in operations thumbing through a stack of tired aviation magazines. As I drained the fuel tanks, the wind blew fuel on my flight suit. It was getting colder.

Back at the operations building, I climbed the wooden stairs to the tower. The weather observer was trying to adjust his instruments.

"What do you see in your crystal ball, Joe?" I asked.

"Not much," said Joe. "Seoul is reporting a high thin overcast about the same as we have. The forecast is for it to be that way all day."

I thought to myself, "No telling what the weather is between here and Seoul. Nothing there but that KMAG outfit. By the time you

go through five switchboards, you can't hear them at all."

With a local observation, a terminal forecast, and high hopes for en route weather, I descended to operations to file my flight plan. Smith was drinking coffee. The operations NCO had started the stove — diesel fuel. I guess I'll never get used to that smell.

I filed the flight plan: one plus three zero en route — VFR; the aircraft had only an emergency instrument panel. Smith gulped down his coffee and grabbed his briefcase.

"I wish the CO was sending me to that meeting in Seoul," I thought, as we walked to the airplane.

Smith climbed into the back and threw his briefcase behind his seat. I helped him get strapped in and climbed into the front seat. The wind slammed the door on my foot. It was getting colder.

I taxied out to the runup area, set the altimeter at 240 feet, and glanced up at the mountains surrounding the valley. Some of the mountains still had their gray clouds. The mountains toward Seoul were clear. There they sat, snow covering their tops like white hats, 2,500 feet high and about 10 miles off the end of the runway. As I taxied out onto the runway I glanced back at my passenger. He was sitting there with a happy smile on his face, reading the latest copy of *Playboy*.

I jammed the throttle forward, and the right wing came up. I eased it back down and kicked in some rudder. "Some day they'll built a runway that points into the wind," I said to myself. The little airplane settled into a steady 500 feet-per-minute climb. I pointed the nose toward the top of the mountains ahead. " Not too bad," I said. "As soon as I clear the tops of these mountains, I'll be

able to see that en route weather." Smith mumbled something inaudible.

The altimeter crept past 2,000 feet. "No sweat. At this rate I'll clear those mountains by 500 feet," I thought, not bothering to key the mike again.

Then it hit. It was like waking up staring at a TV set after the late show is over. There was nothing but blinding white snow. A hundred things flashed through my mind: "Get on the gauges — pilot responsible for the safety of the passengers — get on the gauges — 500 feet per minute climb — clear the mountains." My mouth went dry. "Turn around — 180° turn — keep climbing. I started a slow one needle turn to the left. More power — keep climbing — O.K., roll out."

I felt myself still turning. "Get on the gauges — level the wings — level off." Now I felt myself diving. "Get on the gauges — level off — keep that heading — settle down. If I can just keep this heading, I'll break out."

After what seemed like forever, there it was. Through a hole in the clouds to the left was that long stretch of runway. I started down.

Then I heard Smith's voice. "Hey! What are you doing? I thought you were going to fly me to Seoul!" he said, sticking his copy of *Playboy* inside his jacket.

"Oh," I said, trying to keep my voice from shaking, "I decided you'd have more fun on the train."

I turned final and dropped the flaps.

"What do you mean — more fun on the train?" Smith asked.

I pushed the right wing down, bounced a couple of times, and came to a stop. I taxied to the line and killed the engine. I got out and held the door for Smith. My teeth chattered.

"You aren't cold, are you?" Smith asked.

"You'd better grab that briefcase and run if you want to catch that train," I yelled.

He ran off across the field mumbling something about pilots and airplanes. He wouldn't have understood if I had drawn him a picture. I tied the bird down and filled out the book — Flight number one OK. Then I grabbed the chutes and headed for operations.

Joe, the weather observer, and the operations NCO were drinking coffee.

"Say, Lieutenant!" Joe said. "Guess you got back just in time. Looks like it might snow."

"It might," I said, not bothering to look up.

I closed out my flight plan and walked out the door. The wind blew snow in my face. I zipped up my flight jacket. It was getting colder.

As I walked across the compound I met the chaplain. "You'd better come to church," he said. "You can't fly in this snow."

"Yes, I guess I had better."

the safe way down

A T-6 buzzed our camp and headed for the strip. I sent a Jeep out to meet it and the pilot was soon sharing C rations with us. I was on ground duty with special forces and the sight of an aircraft made me drool. As we ate, I wondered about the trip I needed to make to headquarters. That T-6 could get me there in a couple of hours. By Jeep, it was a rough two-day trip, and I needed to get there and back as soon as possible. It seemed like the ideal solution. I hoped the pilot flew better than he spoke English. At least he understood what I wanted. He grinned and nodded when I asked him about a ride back.

I took along a day's rations, some maps, my .45, and a small survival kit. As we left for the strip, I studied the ominous sky over the mountains toward our destination. I hadn't flown the route, but I knew it crossed 10,000 to 15,000-foot mountains in uninhabited country. The only navaid, a "sometime" operating beacon, was on the field at our destination about 200 miles away.

As we approached the strip, I asked the pilot how he planned to check the weather. He replied that it was impossible until we were within radio contact of our destination. My professional curiosity and will to live instinct raised several questions.

I told the pilot that I was an aviator and he proceeded to give his aerial history. His English was worse, if possible, than my ability to speak his language. But I learned he was an IP with over 2,000 hours, all but 50 in the T-6. He was

not instrument qualified. He knew our route fairly well and the weather at destination was good when he left. He said we had plenty of gas and the en route time would be about one plus four-five.

The plane looked like it was held together by its shiny yellow paint job. It was obviously the only thing new on the aircraft. The tires looked like "Uncle's" initial issue. I found no sawdust in the parachute, as I optimistically put it on while he preflighted. The grass strip was about 2,500 feet long at an elevation of 6,000 feet. It ran parallel to the mountains up the long axis of the valley, with good approaches.

The first hour wasn't too bad. In fact, I had been flying since takeoff. Since the pilot was an IP and I had been authorized to get time in their aircraft, I could at least knock off some pay time. As we flew I kept noticing the ground getting closer to us, though we were at 10,000 feet. I knew the high stuff was yet to come. The sky was overcast. There was no outside temperature gauge. The Long Johns and field jacket were very welcome, especially since the heater didn't work.

The rivers and mountains were quite easy to follow on the map. So far the pilot had not been able to contact anyone. The ground was above us on either side and rising rapidly under us. Being in front, he took the controls and climbed on up to 14,000 feet.

About 30 minutes out, we began to receive radio chatter and an indication of a beacon. Every now and then a puff of clouds would slip by on the right and left. Quite a bit of the ground was hidden by clouds.

We made a positive ID of the last high mountain and passed it. The pilot estimated 15 minutes to destination. Still no radio contact, although we could now receive quite well. The ADF had settled down and seemed to be correct.

We descended to 6,500 feet. Most of the ground was now out of sight. Field elevation at destination was 3,900 feet with 5,000-foot mountains 2 miles north. The ground was then completely out of sight, and cloud tops looked about 500 feet or so below us.

We overheard a C-47 talking with the field, but could not contact either. The Gooney was dropping troops on the airfield. This meant at least a 1,200- to 1,400-foot ceiling. The ADF needle swung on around. I tried to talk the pilot into letting me take the plane and make the letdown. Even though we had no approach, I figured I could get through the stuff safely. My

four month's language study suddenly seemed pitifully inadequate. I could not make him understand. However, he did agree we had at least a 1,000-foot ceiling.

He suddenly did a one eighty and headed back to the beacon. As we got station passage he chopped power, pulled her up, and kicked rudder. Before I could even pucker, we were spinning down through the soup. I put one hand on the canopy release and the other on my safety belt. The altimeter unwound through 5,500 feet.

I wondered if I could get out in a spin. All at once, the ground loomed up. I reached for the stick and stomped opposite rudder. But he was way ahead of me. We made the recovery with altitude to spare and landed.

In operations, the pilot, with the aid of an interpreter, explained his IFR procedure. According to him, it was the most direct, the fastest, and THE SAFE WAY DOWN.

I decided to make the Jeep trip back to base camp. Two days on the road would be very relaxing.

checkout

It had been a good trip. We'd spent the weekend completing the instrument portion of my U-8 checkout in the Tokyo area. The IP filed our flight plan with Tachikawa base operations and the two passengers were aboard, fidgeting around in the back seat as they tried to get comfortable for the flight to Korea.

It was late Sunday afternoon and the weather wasn't exactly "field grade." Broken cloud conditions and a freezing level of 8,000 feet were forecast for our route, and our destination was reporting 3,000 feet and 3 miles. Light rime icing was a possibility, so we'd checked our deicing and propeller anti-icing equipment thoroughly. Also, to be on the safe side, we had requested a GCA standby for our arrival.

The first three hours of the flight were uneventful. I made good on my ETAs. I turned up the instrument panel lights and checked my flashlight as evening faded into dark. Our passengers were asleep and the IP, having verified his confidence in my ability, was relaxed in the right seat, dozing from time to time.

I watched the ADF needle for an indication of station passage. My heading control had been superior, I thought. That needle hadn't moved for 30 minutes.

My ETA for Miho Air Base came and passed with still no station passage. I thought I had better revise the ETA. Could something have happened to the Miho beacon? It seemed unlikely. I could hear Miho station transmitting loud and clear.

Switching the ADF to Loop position, I discovered the needle wouldn't move. My worried thoughts were suddenly interrupted by loud noises on the nose section. The IP stirred from his slumped position and came alert.

"Where are we?" he asked.

"Late! And somewhere around Miho," I replied.

We checked the free air temperature probe on top of the windshield with the flashlight and found it loaded with ice.

I turned the propeller anti-icing system to MAX, and the noise of the props throwing their ice loads grew louder. The IP tried to contact the local GCI (ground controlled interception) station, without success. After a short time, Miho tower answered and we requested a change in altitude and a radar pickup.

Miho answered, "Roger, Army 370. Is this an emergency?"

"Not yet." the IP replied. "But we are picking up heavy ice and our ADF is inoperative. We are unable to maintain 8,000 feet."

That last was an understatement! The airspeed dropped from 145 indicated to 115 despite our wing deicing equipment, power changes, and 5° flaps. The altimeter had started a sickening counterclockwise rotation. Our altitude was 7,500 feet and falling.

Miho advised: "Miho GCA is not in operation and will require 45 minutes to warm up." (it *was* Sunday night.)

"Miho tower, this is Army 370. This is an emergency! Request immediate assistance. Is your DF facility operational?"

"This is Miho tower. Understand declaring an emergency. DF equipment will require 30 minutes to warm up. Turn to a heading of 270°. Descend to and maintain 6,500 feet. Highest obstacle within 100 nautical miles of Miho Air Base is 6,559 feet."

I turned the propeller anti-icing system to MAX and the noise of the props throwing their ice loads grew louder

That highest obstacle versus altitude assignment didn't sit well at all, but there wasn't much choice. We were approaching 6,800 feet and it didn't look as though our sink rate was going to stop just because Miho tower authorized it. The course of 270° would take us away from the coast and the high mountains.

The passengers were trying to get our parachutes out of the storage compartment. But somebody had goofed; they couldn't be reached.

Twenty minutes passed. Our altimeter and ice load reached an agreement at 6,000 feet.

"Miho tower, this is Army 370."

No answer. The IP tried again, with the same result. Our "pucker" factor was on the rise again. The water (?) below and the chance of having a mountainside replace us in the cockpit were in all our minds.

We discussed the possibility of trying for Korea and chancing a radar recovery there, but decided against it because of the weather. Our only chance was to reverse course and keep trying to contact Miho tower.

Finally, Miho answered: "This is Miho tower. Radar contact 18 miles northwest. Turn to a heading of 120°. Descend to and maintain 4,000 feet. Contact Miho GCA at this time."

Good news! But it was short lived.

"Army 370, this is Miho GCA. Radar contact lost 12 miles northwest. Contact Miho DF at this time."

We checked the weather with the landing light and found the answer to Miho GCA's transmission. We were in a blinding snow storm! The IP called Miho DF.

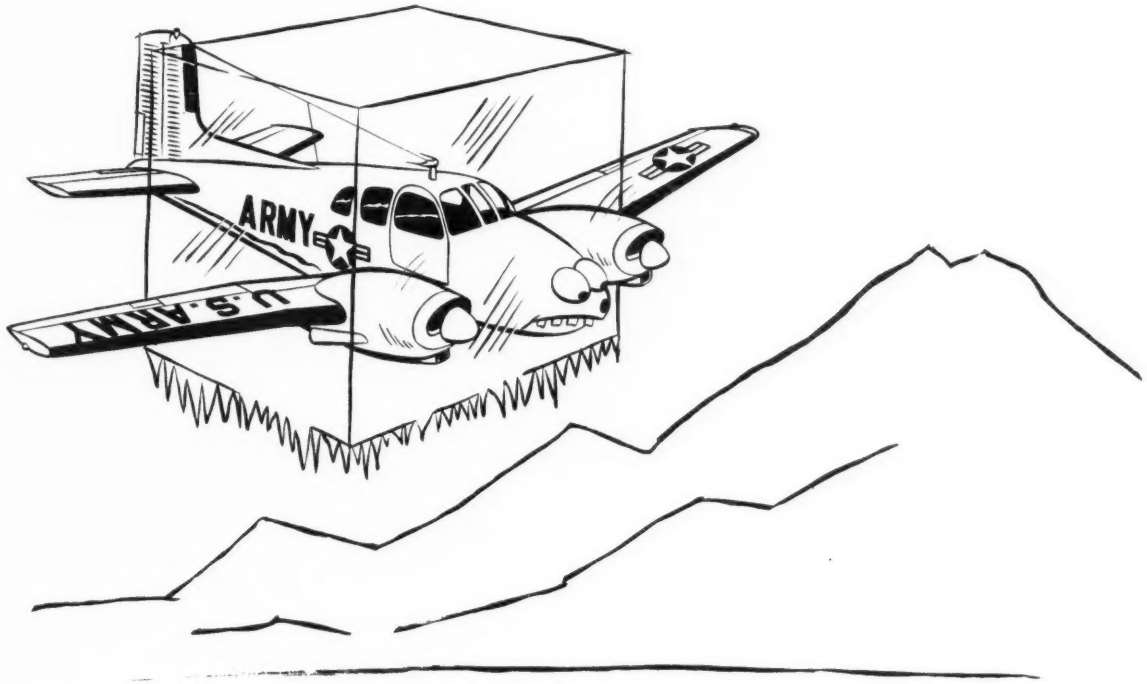
"Army 370, this is Miho DF. Descend to and maintain 4,000 feet. Request type aircraft and true airspeed."

The IP gave Miho DF the information and continued transmitting for 5 seconds every minute or so. The ice was falling off and things were looking up. At 4,000 feet, we were clear of ice but still IFR.

"Army 370, this is Miho DF. Station passage. Turn to an outbound heading of 130°. Descend to and maintain 700 feet. Report reaching 700 feet."

My heart did a flip flop. Did I hear him say 700 feet? "This is Army 370. Verify altitude."

The answer came back as 700 feet and the voice



sounded confident. After another small conference, the IP and I decided we had little choice. Down we went!

"Army 370, this is Miho DF. Miho weather is estimated 1,500 scattered, 2,000 overcast. Visibility 3 miles in ground fog. Wind calm. Altimeter 29.83. Begin standard rate turn to the right to a heading of 320°. Report established heading 320."

The IP was straining to see some lights, but there was only darkness outside. The altimeter reluctantly arrived at 700 feet and the gyro compass ticked off the standard rate turn. We reached the reverse course heading of 320 without any sign of lights.

Maybe we were approaching over water, I thought to myself. If not, the odds against slapping a mountain were rapidly falling. I flicked the landing light off and turned the cockpit lights to low. While I stayed on the gauges, the others strained to see lights.

"Army 370, transmit for 5 seconds."

Only two 10° heading changes had been made since our rollout on final.

"There it is!" three voices yelled simultaneously. Sure enough. I looked up and saw the light of the tower rotating beacon. Then I saw several flashing red beacons — the crash equipment Miho had said would be standing by. I saw the parallel lines of runway lights.

The landing was uneventful and a Follow Me truck led us to the front of a huge hangar. As we unloaded, I heard the PA system blare: "Emergency operations at Miho Air Base are terminated."

against the stops

Imagine yourself flying a CH-21C loaded with 12 combat equipped troops. You have just taken off from a confined area and are climbing out through a narrow draw, about to pass over a saddle about 300 feet higher than your takeoff point. The terrain below consists of flooded rice paddies. The draw is too narrow for a 180° turn, there are three other Shawnees behind you, and eight more ready to go in the takeoff area. A slight gust hits the aircraft and suddenly you realize the cyclic is hard against the forward stops and the airspeed is dropping.

Welcome aboard. You're in the same spot I found myself during a Korean troop lift.

I called for 1½° nose-down trim and yelled for the crewchief to check our loading. The trim didn't help, so I asked the copilot for full nose-down trim.

The airspeed continued to drop and the crewchief reported the loading was O.K. There was no chance of landing without rolling us up in a ball. Nothing to do but hold what we had and hope.

We squeaked through the saddle and I eased off a little power and checked the lateral cyclic. Everything else seemed to be operating properly, but the airspeed was still dropping.

I called the number two aircraft, told him our problem, and asked him to bird dog us until we were on the ground. Then I turned left toward the river ahead. We had used a large, dry rice paddy on the other side as a landing zone a few days before. I hoped it was still dry.

We made it across the river. I breathed a sigh of relief and called for the crewchief to have the troops place their weapons on the floor under the seats. I cinched my shoulder harness tight.

The paddy came in sight. We were down to 60-70 feet and the airspeed was dropping through 50 kt. Suddenly I realized that if I tried to land on that soft ground with the airspeed I'd have to carry to keep control, the gear was sure to be wiped out and we'd roll. I made a split second decision to try for a small hardtop strip 500 yards ahead and to the left, praying the airspeed would hold out long enough to get there with the nose down enough to keep us flying.

The nose was abnormally high already and I figured we'd get the tail cone, but that was a small price for a successful landing. The airspeed continued to drop and I was holding only enough power to keep our descent rate to less than 50 feet per minute. With the cyclic hard against the stops, I couldn't add power except as a last resort. We got down to 75 feet near the strip. This was one approach I couldn't afford to misjudge. The airspeed was 40 kt and falling faster. With each knot lost, the nose came higher.

When we were almost over the end of the strip, I took a chance and added a little power, hoping I'd timed it right for some ground effect on the aft rotor. The main gear touched and I quickly reduced power. The nose gear came down and we were on.

. . . suddenly you realize the cyclic is hard against the forward stops and airspeed is dropping

I applied brakes to stop the roll and released the forward pressure I was holding against the cyclic. I felt a snap and when I tried to move it forward again to taxi, it locked in a position just forward of neutral. Thank goodness I hadn't tried that in the air!

After the troops were off loaded, we removed the inspection cover below the cockpit and found a small ball bearing and cap nut. They were from the forward end of the longitudinal cyclic trim actuator. We were never able to find the cotter pin which should have locked the cap nut in place.

The reason the cyclic locked after I released forward pressure was that the forward end of the actuator shaft had fallen out of a hole in a cross member in which it had been resting in flight and jammed against a solid section of the cross member. If this had happened in flight, about 75 percent of forward cyclic control would have been lost.

When I reported our experience at the home base, all other CH-21s were immediately checked. Of 41 in the area, eight were found with either no cotter pins installed or with the cotter pins installed upside down. These eight aircraft had all recently come from the same overhaul depot. A message was dispatched to the depot and, to my knowledge, no one else had to land *against the stops.*

introduction to night instruments

It was going to be a good night to fly. That was the report the weather man had given. There would be some low ceilings, but the tops were forecast to be 3,500 feet, below the freezing level.

During the drive to the airfield, I took a look at the weather. There was a light misting rain, but the visibility was good. This would be my first night instrument flight since finishing instrument school and I wondered what it would be like.

I met my copilot in the parking lot and we walked to operations.

He was a man about my age, 35. I didn't know much about him, except that he had been around aviation much longer than I had. This would be an instrument flight and he was not instrument rated. The need for a copilot wasn't too great in the aircraft we were flying, so I guessed everything would go all right.

We walked to the aircraft and made the preflight. There were no serious writeups, and the fuel, oil, radios, navigation lights, and other items checked out fine.

Operations was almost deserted, with only the operations sergeant behind the desk. We filed airways to Spokane, our first leg, IFR. The route would be Portland, Ore., Pendleton, Ore., and Spokane, Wash. We estimated time en route at 3 hours and 30 minutes. Our requested altitude was 7,000 feet.

At that time of evening, the weather forecaster for Fort Lewis had closed down for the day, so I called McChord AFB for weather. With the information from the weather man, I completed the weather portion of the flight plan. The en route weather was forecast to be good. On the return from Spokane to Fort Lewis, it was possible a front might move into the Seattle area, but the forecaster figured we would be back before it reached Fort Lewis.

The operations sergeant looked over the flight plan and said he would put our clearance on request. Our passenger was another young pilot going along for the ride.

We cranked up, turned on the radios, and called for taxi instructions. The tower called after we had completed our runup with our clearance, just as we had filed, then cleared us for takeoff. I taxied out, lined up, and opened the throttle.

At 1,000 feet, we went into the clouds. Climbing through, I got to thinking, since this was my first night instrument flight, what would happen if the tops were higher than forecast. The thought caused me to worry a little, but not for long. As forecast, we broke out on top at 3,000 feet.

The flight to Spokane was normal and all checkpoints worked out, right on the money, with clear skies above. As we arrived over Spokane, the weather was clear. For practice, I called for and made an ILS approach. After landing, I taxied to operations and shut down.

A check with the weather forecaster made us feel good. The weather en route to Fort Lewis would be like we had when we left, tops running 3,000 to 4,000 feet and ceilings estimated 1,500 overcast, with 7 miles visibility.

The route of flight was V-2 to Seattle, direct to Fort Lewis, requesting 10,000 feet. Winds aloft for 10,000 feet were forecast at 20 knots from the west. This meant a headwind but I needed the time and this would only add 30 minutes onto our total.

We picked up a passenger at Spokane, a young soldier from Fort Lewis trying to get back after leave. We loaded up and received our clearance to taxi to runway 23. After the runup, I called the tower for our IFR clearance to Fort Lewis. The clearance came through and we were off again for the last leg of our flight. The first checkpoint was Ephrata, Wash. Our estimated time was right, confirming the 20-knot headwind. Ellensburgh was next at 43 nautical miles.

Shortly after leaving Ephrata, I turned on the landing light and could see it was snowing pretty good, but there was no indication of ice forming.

. . . since this was my first night instrument flight, what would happen if the tops were higher than forecast

I could still see straight down.

Arriving over Ellensburgh, we again rechecked our groundspeed, and the wind was still holding at 20 knots. We were still flying in snow and it was getting heavier. I checked our destination weather with Ellensburgh radio. They were still reporting a 1,500-foot ceiling and 7 miles visibility.

From Ellensburgh to Seattle, it was 87 nautical miles. The only weather station between was an eight to five operation at Easton, halfway between. The minimum altitude across the Cascades on V-2 was 8,000 feet. There were no checkpoints between Ellensburgh and Seattle. Our estimated time to Seattle was one hour.

The snow was so thick now that I could hardly see the wingtip navigation lights. I called Ellensburgh radio and requested a descent to 8,000 feet, thinking maybe this would take us out of the heavy snow. We got the clearance, and the snow did let up some as we reached 8,000 feet.

Thirty minutes after leaving Ellensburgh, we noticed we were picking up a little ice. The airspeed had not dropped off any, so we didn't concern ourselves much with it, other than to keep a closer check for more icing. Thirty minutes meant we were halfway between Seattle and Ellensburgh. In about 5 minutes Seattle radar would pick us up and turn us direct to Fort Lewis.

Ten minutes later, I noticed the airspeed had dropped off about 10 miles an hour. When I turned on the landing light, it was easy to see why. We were picking up a lot of ice and in solid cloud. The airspeed dropped off some more. I ran the propeller to high rpm and back a few times to try and keep ice from collecting on it.

Seattle had not called us yet and they should have. I picked up the mike and called. No answer. By this time, I had gone to climb power and the airspeed had dropped to 80 miles per hour (normal indicated airspeed 105).

I tried to call Seattle on all the frequencies I had. Still no answer. Now the airspeed was 70 miles per hour and we were losing altitude slowly. I increased the power to 2200 rpm and full throttle. Now the engine started running rough. A check of the carburetor temperature and I could see why: carburetor ice. Full heat was applied and this smoothed the engine out.

Finally, we established contact with Seattle, but they stated they didn't have a target east of Seattle on V-2.

I requested a lower altitude, but this was not approved as I was already at minimum en route altitude. Seattle then informed me that the winds aloft were 50 knots from the west at 8,000 feet. This was probably why they were unable to make radar contact.

I told them I was down to 7,500 feet and it was all the altitude I could maintain. Radar contact was established, but we were still losing altitude and still holding 80 miles per hour. Radar cleared us to 7,500 feet, but we were already at 7,000.

This continued until we reached 4,500 feet where we broke out between layers. We could see the lights of Seattle in the distance, a welcome sight.

mule train

I was assigned to a small country in the near east as part of a topographic training team. One of my jobs was to fly a classifier over areas coinciding with aerial photographs and help him note down the names of villages, rivers, mountains, and other terrain features. This meant flying from sea level to heights of more than 10,000 feet and landing 15-20 times per flight.

On this morning, the classifier arrived at the airfield as I was preflighting the OH-23D. I finished and briefed the crewchief on our flight route for the day.

The flight to the work area took about 30 minutes. About 15 minutes after takeoff I found I had to increase manifold pressure to maintain altitude and airspeed. While crossing a 7,000-foot ridge to enter the work area, I noticed a further decrease in power. Having experienced a throttle linkage failure in flight one time, I was in no hurry to experiment. Normally, the procedure to follow in picking a landing site was to make a 360° turn relatively low over the area, checking for wind direction, best approach, landing points, etc. In this case, I did it rather high as I made my letdown.

As we touched down the classifier yelled over the intercom, "We are on fire!"

I glanced back and sure enough smoke was pouring from the engine area. I shut down and grabbed the fire extinguisher as I jumped out. The classifier needed no encouragement to depart the aircraft.

The smoke soon stopped. I checked and found the oil very low and signs of oil smoke having come from the oil breather and engine exhaust stack.

I tied the blade down to indicate that no one was injured and the classifier and I began to discuss how we were going to get out of this one. It was 0900 and I was expected back by 1300. Our search plan would be put into effect if I didn't return by 1400.

The nearest U. S. aircraft was 90 miles southeast and I knew one of the team's pilots was to fly there that afternoon. The only thing to do was to attempt to return to base before the search was started. (If a search was initiated, it would mean the unit U-8, plus two from the MAAG unit, and one from the Engineer district, all based 300 miles to the north, would be combing the area in the morning).

I decided the best plan was to obtain some kind of transportation, get to the nearest phone and attempt to contact my mechanic before 1400. In the States, this would have been a simple thing, but I knew the nearest phone was probably 20 miles away. The only way we would get there would be on foot or by animal.

By this time, people from the small villages nearby had gathered around and I was sure this was the first helicopter they had ever seen.

A man who seemed to have some authority stepped from the crowd. Through the classifier, I found he was the mayor of one of the villages. He said he would obtain two animals and a guide for us. He thought we could get to a gendarme post by 1300 if we began right away. While the mayor obtained the animals, I secured the aircraft and made arrangements for two civilians to guard it until my return.

The animals, two mules, arrived with so-called saddles and, at about 1000 hours, we mounted. In a cloud of dust, we began plodding toward home.

We weaved around hills and through valleys. After 2 hours, we came upon a very narrow wire rope bridge, suspended 75 feet above a river. Beside the entrance to the narrow bridge, we saw two men sitting in a tent. One man stepped from the tent and the classifier recognized him. As was the custom, we were offered tea and cookies. It looked as if we would not get to a phone by 1400 hours, so we accepted. After a rest and refreshments, we crossed the shaky bridge and began to climb the last obstacle, a 7,500-foot mountain.

During part of the climb to the top of the mountain, we led the mules, as it was too steep to be sure they would not slip. At one place, we saw the carcass of a mule that had slipped. Three-quarters of the way to the top, I recognized the distant sound of an O-1 and it soon came into view, following the course I would have flown

in a cloud of dust, we began plodding home

that day. We were in the shadows between two ridges and I could not use my signal mirror. The Very pistol did not attract his attention, so I stood and watched, feeling helpless.

By the time we had reached the top of the mountain, it was 1800 hours and getting dark. Again, I heard and saw the O-1. But again, I was unable to attract the pilot's attention. From the top of the mountain, we could see the town where the gendarme post was located. It looked to me like it was only two hours away, but I found I was a poor judge of animal speed.

It was pitch dark when we reached the bottom of the mountain, and the guide said we would have to rest the animals. He knew of a small village a few hundred yards ahead where we would be welcome.

We hobbled the mules in front of the village and were invited to enter one of four mud and straw huts. The only light came from a small fire burning in the center of the dirt floor. We all huddled around the fire and were offered tea.

Shortly, we thanked our host, gathered the mules, and began the last leg to what we hoped was a telephone. It was midnight by the time we arrived at the gendarme post and found the phone out of order. We asked about a vehicle and found an old American car and a driver for hire. An 18-hour drive and we were home at last.

it's dark down there

It was a typical primary solo night cross-country briefing. The weather was marginal, but we were behind in flying hours, so they had us stand by. Finally, the airborne instructors called the tower and reported that the ceilings at the en route check-in points were about 2,000 feet. The wind at altitude was 25 knots from the northeast.

Our route ran from Lowe Army Airfield to Troy, Ala., north to Montgomery, and back to Lowe.

With my flight all planned, I took off in my assigned O-1A. This should be easy, I thought. It was the same route my instructor and I had flown a week earlier on our dual night cross-country.

Shortly after takeoff, I saw a forest fire and noted its location in respect to Lowe. Approaching the first checkpoint, I made a routine call to the airborne instructor and turned north to Montgomery. This leg took 10 minutes longer than my trusty E6B had predicted. Noting this, and making a wild guess for drift correction, I headed home.

A short time later, my good "coffee grinder" music was interrupted by a voice on the VHF frequency: "This is Lowe tower. Be advised that Lowe Field is closed due to high surface wind conditions."

I learned later that the tower call was made as a result of two groundloops by landing solo students. The plan was to have all remaining aircraft land at Cairns AAF where the runways were more favorable for the wind.

My ETA came and went. Still no lights. It looked as if everybody in South Alabama had gone to bed. I did see two other planes heading due east, but I wasn't about to follow them. It was quite apparent to me that they were lost!

At ETA plus 10 I spotted two split beam rotating beacons and I relaxed.

After another 15 minutes I saw a forest fire. Then I knew exactly where I was. I patted myself on the back for noticing the fire on the outbound leg.

Then a funny thought struck me: Where were the other planes? Surely I wasn't that late.

I made a low pass by the first field which I thought was Lowe, until I saw the red and white tower. I couldn't recall Lowe tower being painted recently. Turning toward the next beacon, I saw an MP gate below. That would be the entrance gate to Cairns. Or was it? I decided I had better climb and give Cairns tower a call.

The smoke from the forest fire had really spread, I thought as I climbed.

"Cairns Tower, this is Brown Hat 36. Over." There was no answer.

With a new voice inflection, based on sheer panic, I transmitted again:

"Any aircraft receiving Brown Hat 36, give Brown Hat 36 a call."

The calm voice of my instructor, framed in static, answered and asked for my present position.

"This is Brown Hat 36. I am over two unidentified military airfields at 4,000 feet."

His next transmission was blocked by static, but I heard something about VFR and present altitude. I called him again and confirmed 4,000 feet as the altitude and stated that I was in some heavy smoke.

"Brown Hat 36, descend immediately! Contact the nearest airfield tower on frequency 243.0 and land!"

Descend I did. The smoke, which I later found was heavy cloud, was all the way down to 900 feet and I couldn't see the two airfields any more.

To make matters worse, the few lights I had seen on the ground earlier had disappeared. My fuel gauges were both in the "do not take off" position. Between them, I figured I had at least 40 minutes to "engine sputter time."

Flying with the stick between my knees and my flashlight in one hand, I managed to change the radio frequency.

"Any station receiving Army 57314, give me a call on 243.0."

There was a loud and long silence.

Then my plea was answered: "Army 57314, this is Eglin tower."

Eglin! That's in Florida!

"This is Army 57314 on a student solo night cross-country from Fort Rucker. Request a DF steer." I carefully omitted the word practice.

"Roger. Turn to a heading of 053 degrees. Cleared straight in runway O1. Report 1 mile final. Wind is northeast, 20 knots, gusts to 30 knots. Contact tower on 236.6."

Then I knew! The dark countryside where I could see no lights had to be the *Gulf of Mexico!*

omega

Continued from page 31

not know, you will teach. Those who do not care will tend to belittle your efforts, and no logic on your part will dent what appears to you to be the concrete grooves of their brain. Your flight pay will be eyed with envy; your warm and comfortable flight suit and jacket will be restricted to the cockpit only; your every suggestion and recommendation will be viewed with suspicion, since it is obvious you have something to sell; and your list of extra duties will grow like dandelions in a lawn.

Accept now, once and for all, the fact that you must continually do more than your nonflying contemporaries to prove your worth. For an Army Aviator, there are no soft assignments. You are always on trial, and you are expected to doubly earn your extra pay. Do so. Take your complaints home to your wife. She will be much more sympathetic, and frankly, she'll do more about them than will those whom you have been unable to convince.

Despite day-to-day setbacks, Army Aviation has made more progress during the past 10 years than has any other segment of the ground forces. This happened because certain of its proponents refused to become discouraged. I hope you will join that group.

My second point: *Think.* The helicopter you fly does not have this capability, and left to its own devices will fly off in all directions at once. Yet, you can control its actions through the guidance provided by your brain. Accidents do not just happen; nor is progress brought about by circumstance.

Army aircraft were initially intended as elevated observation posts to be flown up and down the line of artillery weapons while the observer peered into the battle area. That they are no longer so restricted is due in large part to a dedicated group of nondiscouraged individuals who thought they could do better and proceeded to prove it. The Combat Developments Command and its Aviation Agency are continually searching for new and better methods for accomplishing the operational mission assigned Army Aviation. They will welcome your suggestions. They need your imagination and your reasoned thoughts. For that matter, so does the entire free world.

Point number three: *Retain your enthusiasm.* Today many people tend to adopt a cynical attitude toward those attributes once considered sterling qualities. I refer to such things as honor, integrity, and patriotism — things which are as necessary to the Army officer as is his breathing. We have already agreed that you will not allow yourself to be discouraged by disinterest, but that is not enough. You must retain your beliefs, express your desires, and prove, over and over again, your willingness to labor in the cause of your army and your country.

When one loses his enthusiasm, he has lost his capability to grow. Since no one can admit to himself that he is finished, he hunts an excuse, a reason for his standing still. Often, he accepts the easy way out, the "What's the use?" attitude. There has never been nor will there ever be a constructive thought or a progressive move from such people. I urge you to ignore them and to retain that desire to improve yourself, your family, your army, and your country.

My last point: *Grow.* Physically, this presents no problem. Sooner or later, you and the flight surgeon will have words regarding your middle. Time will take hair from the top of your head, and combat boots will add calluses to the soles of your feet. Time will also add to your experience, 75 percent of which will be absolutely of no value.

Only you can make time an ally. Learn the problems of the man you support. Learn the problems of the man he supports. Note their solutions and file them for future reference. Tomorrow you will be expected to reconnoiter a position area, but next week you may write an annex to the operations order. Aviators have filled every command position from USCONARC through STRAC, the Aviation School, an infantry division, to an infantry platoon. They are instructors at service schools and staff officers at every level.

The future of Army Aviation — and, at the risk of appearing to exaggerate, the future of our One Army — is largely dependent upon the ability of individual Army Aviators to expand and grow, accepting greater responsibilities as their capabilities allow.

There are literally thousands of people in the world today who envy you, who would gladly trade places with you, but who unhesitatingly wish you well. Add me to that list.

* * *

That's what your guest speaker might have said at your graduation had he been willing to talk and what you might have heard — had you been willing to listen. At the end of a flying career which began in 1943, a career into which I reluctantly entered and even more reluctantly depart, they are the words I'd like to say.

Sophisticated electronic gadgets can never substitute for old-fashioned common sense. Your personal warning system should always include a generous supply of this commodity.

Warning Systems

Captain Nick Leone, Jr.

Captain Leone is assigned to the 11th Air Assault Division, Ft Benning, Ga.

BACK IN THE days of white silk scarves and sheepskin lined flight boots, the pilot's first indication of an inflight emergency was usually when the comfortable hum of the engine changed either to a series of sharp explosions or to dead silence, and the acrid smell of something burning and a rise in temperature around the soles of his glossy boots told him he was on fire. Of course, there was little for him to do except execute a nylon approach or find a suitable field and land in a hurry.

Today, with more sophisticated aircraft we have inflight warning systems to supplement the pilot's five senses. Our problem now is to use these warning systems correctly. "No easier said than done," you reply. Let's look at the record before we come to any hasty conclusions.

Take the case of the IP and his transition student in the CV-2B. While out sharpening up on control touch maneuvers the fire warning light, indicating a zone 2 and 3 fire in number one engine, proceeded to glow like a red Cyclops eye. A visual check of the cowling showed no indication of a fire but, to be on the safe side, number one was feathered and they turned homeward.

Then, the zone 1 light for number two engine heralded its presence. Since the IP, understandably, didn't want to shut down the only remaining engine, he declared an emergency and landed at home field as fast as he could. On the ground a check was made and maintenance repaired the faulty warning light systems.

By now you're probably asking, "Well, what about the engine instruments?" and "Did they activate the fire extinguishers?" If you are, pat yourself on the back.

What about those engine instruments? Usually, an inflight fire will give more indication than just the warning lights. A drop in fuel, oil, or hydraulic pressure are some. An increase in carb air, oil and/or cylinder head temperature are others. And, naturally we still have our senses of sight, touch, smell, and hearing to assist us.

Every possible means should be used to determine whether you have an inflight emergency or just a minor malfunction. Not doing this can sometimes turn a minor malfunction into a major accident. For instance, the audio warning and warning light indicating an engine failure on a UH-1D came on while the pilot was cruising at 1,300 feet. The N-2 tachometer unwound and the pilot entered autorotation immediately. On the way down he attempted a restart with no apparent success. Not so fortunate as our Caribou crew, he landed in scrub pine trees and the aircraft was seriously damaged. A visual crosscheck of the other engine instruments (N-1, torque, EGT, etc. would have indicated that THE ENGINE WAS STILL FUNCTIONING PROPERLY.)

Does this mean we should forego our fancy warning systems and return to the five senses only? Of course not. What it does mean is that the warning systems must be interpreted with sound common sense and cool-headed judgment. Here are some points to remember when that fire warning light comes on or the audio warning beeps in your ear:

Don't panic. Assess the situation accurately.

Crosscheck other instruments for verification of fire or engine failure.

If possible, visually check for signs of fire.

If an actual emergency exists, perform your emergency procedure and land as soon as possible.

If you have determined you have a defective warning system, land and have it repaired. Remember, as long as the system malfunction exists you have lost your detection capability for the affected area.